ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

Our Fall Program

We recall that even Herbert Hoover waxed poetical over the value of fishing to tired business men. Well, we caught a big fish — we have the picture — and are now back at work rested and yet ambitious. So here is a brief announcement of our immediate plans.

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Smoked glasses are still universal in application. There is a national plan to remove them this fall. So in our September 9 issue we talk about electric light — the national plan, the markets, the organization to sell light and the uses of light. Much new sales and application material is available.

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Industrial codes force manufacturers to keep cost accounts, to sell at a profit and to limit plant extensions. This gives the electrical engineers a chance really to electrify industry. Instruments, controls, new electrical devices — all these will get more production at less cost. We hope to get citation articles and solicit competent contributions.

●

And this is a part of commercial sales for all electrical markets. We hope to survey the competitive power situation, to put some new ideas into home merchandising, further to apply electric welding and electric heat. Business is coming back, people have some money. The electrical industry must get its share of the market.

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And now for engineers. This is their time to ring the bell despite assertions that engineering is all over. We claim that practically all utility systems and industrial plants can be rebuilt or remodeled at a profit. An enormous technological advance has been made during the depression. We shall trot out these engineering bombs and throw them where they will do most good.

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Above all, we are going to work on editorials. We hope our knowledge, observation and perspective are sufficient to utter some opinions that will help the industry go forward. This is a period of change and our editorials will try to point principles which if applied will be permament and sound. Ambitious, of course — that is the inevitable reaction from vacations in the woods.

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SEPTEMBER 2, 1933

Contents, Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.

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ELECTRICAL WORLD—Published weekly, price 25 cents a copy. Subscription rates—United States, Mexico and Central and South American countries $5 a year. Canada, including duty, $7.50 a year. All other countries $9, or 45 shillings, a year. Entered as second-class matter January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable address: MCGRAWHILL, New York. Member A.B.P. Member A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 W. 42d ST., New York, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London W.C. 2; Washington, Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

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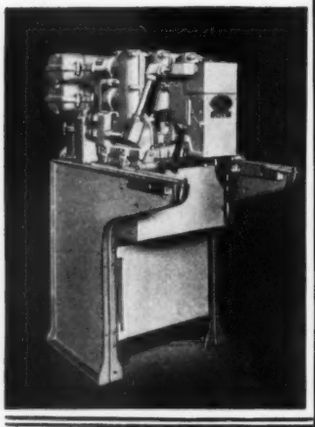

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ELECTRICAL WORLD

Established 1922—McGraw-Hill Publishing Company, Inc.

for the Week Ending

September 2, 1933

L. W. W. MORROW, *Editor*

Engineers, front and forward

BEHIND temporary palliatives lies a necessary and fundamental readjustment to bring back stabilization and prosperity to industry. There are changed values, a new technology, sounder economic and management principles that must be used and applied. Too few appreciate the very drastic action that must be taken.

Engineers know and are fully competent to act on those matters that come within their province. They know, but are keeping silent, about the terrific technological and economic obsolescence that exists in the present mechanization and production aspects of both the utility business and in industrial plants. Many privately remark that they can reproduce present machine assemblies in better form today to give better and more economical results at half the investment made already. Many state, however, that executives do not know these facts and do not wish to know them and that they would be more apt to be fired than congratulated if the facts were presented to executives. This is the policy of cowardice both upon the part of engineers and of executives. The facts must be made known and they must be acted upon.

If 90 per cent of the textile looms are high-cost and obsolete devices this fact should mean an opportunity for the textile industry. If a steam power station can be built now for $50 a kilowatt or less, this fact should be known. If a small production factory with a foreman in charge is the economic industrial unit, this fact points to the future expansion program of industry. New equipment, new methods, new assemblies—all devices and methods that do things more cheaply and better—must be brought forth and used. It is not now and never has been a principle of American business that the *status quo* in investment or in mechanization must be protected. It cannot be protected. On the contrary, progress has been had by scrapping obsolete equipment and writing off old investments so that new markets might be opened through the sale of a cheaper and better product or service.

If the business, financial and legal minds in charge of industry do not know the facts, or do not wish to know them, that is no excuse for engineers to keep silent. Somebody will use the full possibilities of this new era—this is the cause of the inevitable rise and fall that accompanies the growth of business enterprises. It is the duty of the engineers to tell the truth and present the facts, even though intrenched business executives do not call for these engineering reports and do not wish to act upon them. Down deep in the industrial structure these facts are being used now and are creating the fringe competition that will grow into an engulfing wave unless recognized and acted upon. This is the time of opportunity for engineers to measure up to their responsibilities. They should seize it without fear or favor.

—— and high time to quit stalling

However distasteful to management in the electric utility industry the current tide of political and regulatory adverseness may be, it is real. Real as the rate cuts that are ordered. Real as the unfriendliness and lack of sympathy that it engenders in the public mind. Real as the dangers that lie not so far ahead.

Many of the present difficulties are due to misunderstanding, on the part of the public, on the part of politicians, and on the part of utility men themselves. All parties need a quiet session with inescapable facts. Primarily the lead and the responsibility rest upon the utilities. Before the demise of N.E.L.A. it was becoming evident that temporizing with the temper of the public was the order of the day, particularly where holding company executives and bankers were directing utility affairs closely. After N.E.L.A. one looked in vain for an E.E.I. code of ethics and a plan to initiate action faster to reach public understanding. Today the light and power industry of the nation still stands on the brink of a precipice, to reclimb which may require countless years of unremitting toil.

The public temper of the day requires frankness and fair dealing on a hitherto undreamed-of scale. No stopping short of disaster is likely where less than this is offered. There has been much talk of write-ups; there will be more talk of just as tangible write-downs. There has been much talk of fair values; there will be more talk of investment values. There has been much talk of return on the property; there will be more talk of return on specific kinds of securities and to kinds of owners. There has been much said of equities in rates; there will be vastly more pointed remarks made of rates, not as affecting customers as a whole, but as applied to groups of customers classified as to domestic, commercial and industrial. Unpleasant, yes, but real.

To face reality requires more than good humor, or tact, or publicity. It requires compromise, far-sighted courage. There is not time to wait for a vast deal of house-cleaning to be done in some badly ordered mansions, fortunately not in the majority, but nevertheless destroying the good name of the electrical community. This should be done, but in the meanwhile there should be formed an industry council of qualified operating company spokesmen to consider all conditions and to formulate a plan for action. With definition of principles, with an analysis of facts and with commitments as to policies, the public and the utilities may arrange peace; without that meeting of the minds there can be but interminable strife and ultimate defeat for the utilities. It does not matter whether or not one likes the situation, it is here.

Industrial management— an electrical market

Under the NRA codes primary industries very largely agree to restrict their plant extensions and to sell on a cost-plus-profit basis. This means that alert industrial plant managers will use every possible opportunity to reduce costs and to improve the productive efficiency of their equipment and labor. This fact offers a big marketing opportunity to the electrical industry—motors, wiring, lighting, controls, electric heat, electrical instruments.

Each factory requires a modern wiring layout and an adequate lighting system. But beyond this each production operation can be studied and improved. Each machine can be equipped with controls and instruments so that management can know it operates at maximum efficiency. The introduction of electric heat, electric welding and electric instruments offers other opportunities to improve production efficiency. The program is one of modernization.

Utility power salesmen and representatives of manufacturers and contractors should go after this business. They must first be competent and informed themselves before they are able to go into the plants and make recommendations as the result of an intelligent analysis. Industrial executives are far from sold on modern electrification and are uninformed as to new equipment or the possibilities that lie fallow through the use of electrical accessories. The sales task is difficult, but this is a most opportune time to open this large market so that future industrial expansion will fully utilize electrification and so that present conditions may be capitalized upon.

THE WEEK

Illuminating Engineers Prepare to Push Lighting Sales

"LIGHTING is a service, the use of which is entirely in the hands of the consumer. It can be increased or decreased at will. Because of this flexibility of lighting and the powerful economic forces which have brought about its reduction in use, it will only be through energetic effort and education as to its value and proper use that better lighting as such will return. Lighting is right now in a position readily to grow. It can be the first part of the electrical industry to respond to business recovery." This thought, stated by George E. Whitwell, chairman sales committee, Edison Electric Institute, set the tone for the lighting service conference which preceded the technical sessions of the Illuminating Engineering Society convention this week at Lake Delavan, Wisconsin.

Accomplishments recounted

The general thesis of the present opportunity in lighting sales, stated by Mr. Whitwell, was upheld in detail by an excellent series of papers dealing with specific methods for sales in the various fields of lighting application.

How customer's service maintains and increases lighting load for the Commonwealth Edison Company was described by M. W. Ross. He told how owners of vacant stores had been persuaded to retain electric service for its advertising value after the tenants' removal, how 49,673 orders for a total of 367,638 lamps were secured in residences by fourteen men during the first six months of 1933, how commercial and industrial customers have been continuously contacted in order to combat their tendency toward the reduction of lighting and how the company was able to sell portable indirect lamps at the rate of 3,000 per month.

Where opportunities lie

In the discussion Freeman Barnes outlined four directions for utility efforts—filling empty sockets wherever they are found and utilizing new sales methods in commercial, home and outdoor lighting. Charles Poey, New York & Queens Electric Light & Power Company, presented an analysis of results from a nationwide survey of lighting conditions in 2,907 industrial plants, in 182 cities, which showed that the average foot-candle intensity in industry is only 2.85, watts per square foot of area light only 0.63; in more than 54 per cent of the plants obsolete lighting equipment is used and the average age of all industrial lighting equipment is 7¾ years.

Seconding the implications of this report, R. W. Staud, Benjamin Electric Manufacturing Company, indicated that it was time for the manufacturers of lighting equipment to get together on a plan of market development, particularly in view of the NRA promises of reform in manufacturing and selling. This thought was accentuated by M. E. Skinner, Niagara & Hudson, who reemphasized the responsibility on manufacturers for the promotion of lighting equipment sales.

The case for street lighting

In the technical session of the convention, which followed the commercial exuberance of the first day, there were a number of significant papers. Among these was one by Richard E. Simpson, Travelers Insurance Company, giving a general review of day and night traffic accidents in 227 American cities. Included in this review was a detailed comparison of the traffic accident experiences during 1931 and 1932 of one group of cities with increased street-lighting expenditures and of a second group with reduced street-lighting budgets, proving that good street lighting is an actual life preserver. The survey shows that one group of cities with low per capita street-lighting costs (that is, cities that might reasonably expect considerable benefit from better street lighting) actually do benefit to the extent of a 33 per cent reduction in fatalities by an increase of only 8 per cent in per capita street-lighting costs.

An interesting survey paper was that by A. L. Powell, J. M. Smith and A. Rodgers, General Electric Company, under the title "Has the Passing of Two Decades Affected Practice in Lighting Ordinary Small Stores?" Undoubtedly due to the poor business conditions in the past three years it cannot be said that lighting small commercial establishments is now greatly improved over what it was ten years ago, but from their experiences in collecting the data the authors stated their conviction that if the survey had been made in 1928, 1929 or 1930 the average watts per square foot would have been appreciably higher than found in 1922.

Following adjournment of the convention at Delavan the delegates were moved en masse to Chicago, where special demonstrations and illumination displays were put on for them at "A Century of Progress."

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Tropical Storm Menaces Atlantic Coast Service

Heroic efforts by operating and maintenance forces of electric light and power properties along the middle Atlantic seaboard minimized but could not preclude many interruptions in the three-day tropical storm of last week. From the Carolinas to New England heavy winds and driving downpours were responsible for wires down, fires and damaged service equipment.

Centering between the Virginia capes and Delaware, Maryland properties took the worst of the attack. On the Eastern shore flood conditions prevailed widely. Consolidated Gas, Electric Light & Power Company of Baltimore reported the worst conditions in 25 years.

In explaining the situation through newspaper ads on August 24, after the worst of the storm was over, President Herbert A. Wagner of the Consolidated company pointed out that "both Baltimore and Washington were most fortunate to have service from the large hydro plants at Holtwood and Safe Harbor on the Susquehanna River, for both here and in Washington vital equipment completely flooded in the steam power plants caused these plants to be inoperative throughout Wednesday night. But for the plants on the Susquehanna River both of these cities would have been in complete darkness."

Washington shut down

Rising water at the Washington, D. C., Bennings station of the Potomac Electric Power Company on the Anacostia River came in a sudden wavelike rush which suddenly engulfed the plant at 6:30 in the evening, submerged the lower floor with four or five feet of muddy water and stopped various items of apparatus. It was necessary to bank all fires and for the first time since 1906, when the first section of this plant was started, this 208,000-kw. sta-

tion was completely inoperative. Company workmen raised a cinder and gravel dam 8 ft. high for 300 ft. partly around the plant and when pumps had, with the assistance of municipal fire-engines, cleared the vital areas the station resumed operation early the following morning.

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Electrical Contracting Code Includes Transmission and Distribution

DRASTIC insistencies as to conduct of business, acceptable practices, rates of compensation and qualifications for activity are incorporated in the code submitted to the NRA on behalf of the electrical contracting industry by the National Electrical Contractors Association. The code has been submitted, and September 6 has been set for hearing by NRA officials. Chief of the features are: Inclusion of transmission and distribution construction; minimum wage and 35-hour week; establishment of a policing board; provision for contractor qualifications, including training, being an employer, having place of business and financial stability; definition of "true cost"; establishment of secret agreements ban, no rebates, and one-bid policy; contractors to finance own payrolls.

Articles I and II consist of definitions of the terms and designations of the code. The balance of the proposed plan reads:

ARTICLE III—EMPLOYMENT PROVISIONS

Section 1. As required by Section 7 (a) of Title I of the National Industrial Recovery Act, the following provisions are conditions of this code:

(a) Employees in the electrical contracting industry shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint or coercion of employers of labor, or their agents, in the designation of such representatives, or in self-organization, or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection.

(b) No employee in the electrical contracting industry, and no one seeking employment therein, shall be required as a condition of employment to join any company union, or to refrain from joining a labor organization of his own choosing.

(c) Employers shall comply with the maximum hours of labor, minimum rates of pay, and other working conditions approved or prescribed by the President.

Section 2. Minimum Wages—(a) On and after the effective date, the minimum wages that shall be paid by any employer to electrical workers engaged in the installing, altering, repairing or maintaining of electric wiring, devices, appliances, or equipment, shall be not less than the minimum rates which are established regionally or locally by mutual agreements between truly representative groups of employers and employees, and approved by the President, as provided by Section 7 (b) of the National Industrial Recovery Act.

(b) Where such rates are not so established, the minimum rate of wages shall be:

1. For electrical workers having three years or more experience as wiremen, fixture installers, maintenance and repair men, engaged in installing or altering electric wiring, devices, appliances or equipment, excepting transmission and distribution work, not less than 60 cents per hour, unless the hourly rate for the same class of work on July 15, 1929, was less than 60 cents per hour, in which case the hourly rate shall be not less than that of July 15, 1929, and in no event less than 50 cents per hour.

2. For electrical workers employed on transmission and distribution work, not less than 40 cents per hour, unless the hourly rate for the same class of work on July 15, 1929, was less than 40 cents per hour, in which case the hourly rate shall be not less than that of July 15, 1929, and in no event less than 30 cents per hour.

3. For process workers in electrical repair and service shops engaged in the repair of electrical motors, generators, transformers and equipment and in labor operations directly incident thereto, not less than 40 cents per hour, unless the hourly rate for the same class of work on July 15, 1929, was less than 40 cents per hour, in which case the hourly rate shall be not less than that of July 15, 1929, and in no event less than 32 cents per hour.

4. For unskilled workers, not less than 40 cents per hour, unless the hourly rate for the same class of work on July 15, 1929, was less than 40 cents per hour, in which case the hourly rate shall be not less than that of July 15, 1929, and in no event less than 30 cents per hour.

(c) The minimum rates of wages shall apply with equal force to any contractor who works with tools, and he shall charge his time so occupied at said rate to each job, as though he were an employee.

(d) The minimum wage for clerical workers and other employees shall be not less than $15 a week in any city of over 500,000 population, or in the immediate trade area of such city; nor less than $14.50 a week in any city between 250,000 and 500,000 population, or in the immediate trade area of such city; nor less than $14 a week in any city of between 2,500 and 250,000 population, or in the immediate trade area of such city; nor less than $12 a week in towns of less than 2,500 population. The provisions of this paragraph (d) shall not apply to establishments employing not more than two persons in towns of less than 2,500 population, which towns are not part of a larger trade area. Population shall be determined by the 1930 federal census.

(e) Nothing herein contained shall be construed to apply to employees whose rates of wages are established for specific projects by competent governmental authority in accordance with law, or with rates of wages established by contracts now in force.

Section 3. Maximum Hours—(a) On and after the effective date, employers shall not employ any electrical worker more than an average of 35 hours a week for any calendar month, but with the right to work a maximum week of 48 hours in such period but not more than eight hours in any one day, except those in executive, administrative and supervisory positions, and except in cases of emergency requiring the protection of life or property and for maintaining safe and continuous electrical service for the public, and excluding establishments employing not more than two persons in towns of less than 2,500 population, which towns are not part of a larger trade area. Population shall be determined by the 1930 federal census.

(b) A supervisory position is defined as one in which the person occupying it does not work with tools.

(c) On and after the effective date, contractors shall not work any employee engaged in accounting, clerical, office, sales (except outside salesmen), or drafting work more than 40 hours in any week, excluding employees in managerial or executive capacities and those in establishments employing not more than two persons in towns of less than 2,500 population, which towns are not part of a larger trade area. Population shall be determined by the 1930 federal census.

(d) Nothing herein contained shall be construed to apply to employees whose hours of labor are established for specific projects by competent governmetal authority acting in accordance with law, or with hours of work established by contracts now in force.

(e) Nothing herein contained shall be construed as preventing voluntary agreements establishing a lesser maximum hours as provided in the National Industrial Recovery Act.

Sections 4 and 5 refer to minimum age provisions for workers (sixteen years) and to labor welfare provisions.

ARTICLE IV—ADMINISTRATION

Section 1. Refers to power to amend the agreement.

Section 2. Administrative Agency—(a) To effectuate the purposes of this code and provide for its administration within the electrical contracting industry there is established a "National Code Authority for the Electrical Contracting Industry," seven members of which shall be appointed by the executive committee of the National Electrical Contractors Association from the membership of the association, and not more than three members of which the administrator may from time to time appoint as representative of the industry but not members of the association.

(b) The National Code Authority may adopt such rules, and take such actions, and conduct such investigations as may be necessary to effectuate this code, and to that end may establish subcommittees and

subordinate occupational, state, regional or local administrative committees and prescribe such duties, rules and regulations as are deemed necessary to carry out the purposes of this code and the National Industrial Recovery Act.

Sections 3, 4, 5, 6 and 7 refer to duties and powers of Code Authority, to division of expenses, to adjustments of existing contracts, to the protection of small enterprises and to policing of the code.

Article V—Regulation of Fair Competition

Section 1. For the protection of the public, the industry recommends that an electrical contractor should have the following qualifications:

(a) Be generally qualified by his technical training, and/or experience in the industry, to direct properly the installation, altering or repairing of electric wiring, devices, appliances or equipment.

(b) Be an employer of electrical workers.

(c) Have an established place of business, and maintain a proper set of books and records incident to the conduct of an electrical contracting business.

(d) Be financially able to operate his business properly.

Section 2. The nature of the contracting business requires the preparation of detailed estimates of individual cost for each job. No contractor shall submit an estimate price on any job, or submit a bill for his services, without retaining a record showing the true cost upon which his estimate is based or his charges were determined.

Section 3. No contractor shall sell or offer to sell labor, materials and/or services below the true cost thereof, as defined herein.

Section 4. The term "true cost" is defined as the sum of:

1. Materials.
2. Labor.
3. Job expense, which shall include:
   - (a) Drafting.
   - (b) Delivery of materials.
   - (c) Railroad fare (or equal) if any.
   - (d) Hotel expense, if any.
   - (e) Municipal permits, inspection fees, if any.
   - (f) Public liability and compensation insurance.
   - (g) Group insurance, if any.
   - (h) Tool repairs and replacements.
   - (i) Any other direct expense.
4. Overhead or administrative expense.

Section 5. The overhead or administrative expense shall be figured upon the actual overhead percentage of the individual contractor, based upon his experience with the volume and character of his business, as determined by recognized standard accounting methods in the electrical contracting industry, but the overhead shall not in any case be figured as less than 15 per cent of the combined cost of (1) materials; (2) labor, and (3) job expense.

Section 6. (a) An accurate knowledge of costs is indispensable to intelligent and fair competition. Every contractor shall use an accounting system which conforms to the principles of and is at least as detailed and complete as the uniform and standard method of accounting set forth in the Manual of Accounting Practice and Standard Accounting System prepared and published by the National Electrical Contractors Association, and a costing system which will provide as complete and detailed knowledge of costs as necessary to properly carry out the provisions of this code.

(b) Provides for gathering of cost and expense data.

Section 7. (a) The local administrative committee, as may be appointed by the National Code Authority, shall be empowered to investigate any violation of this Code and to call upon any contractor within that territory for such data as may be needed to effectuate the provisions of this code.

(b) Any expenses incurred by such local administrative committee shall be borne by the regional or local electrical contractors' association designated by the National Code Authority as having jurisdiction.

Section 8. No contractor shall make any secret agreement with a purchaser concerning any terms of payment, rebate or special conditions not extended to all bidders.

Section 9. The industry approves of the "one-bid" policy. No contractor shall change his bid price except for variation in wages or material prices, or substantial changes in the original plans and specifications, and then only to an extent consistent with the actual change of cost involved.

Section 10. No contractor shall submit a bid on any work after the closing time set for receiving bids or after other bids have been opened.

Section 11. No contractor shall in any manner or degree engage in or resort to or be a party to the unfair practice known throughout the industry as "bid peddling."

Section 12. (a) Each local administrative committee appointed by the National Code Authority to have supervisory jurisdiction of this code in its territory, shall designate a depository for bids, which shall be a bank or trust company approved by the National Code Authority.

(b) Contractors bidding on any job amounting to $250 or more shall file sealed copies of their bids, and any revisions thereof, with such designated depository, who shall hold same, sealed and confidential until after the bids have been opened.

(c) Each contractor bidding on such jobs shall indicate in his proposal to the purchaser that copy of same has been delivered in sealed envelope to the designated depository.

(d) Upon notification that the contract has been awarded, or that the bids have been opened, the depository shall deliver all copies of bids for such work to the local administrative committee having supervisory jurisdiction. Such committee shall open all bids, tabulate same and send copies of such tabulations, together with details of contract award, to each bidder who shall pay to the local administrative committee his equitable proportionate share of the cost of handling, tabulating and distributing such information, but not over $1 for each bidder.

Section 13. (a) Upon the request of a bidder, the local administrative committee shall appoint a committee of review, composed of not more than three persons who are not bidders on that job, which committee shall be empowered to call upon all the bidders for any data deemed by the committee necessary to determine whether this code of fair competition has been violated.

(b) In the event the committee of review shall find that this code of fair competition has been violated their findings on the violation shall be reported to the local administrative committee, for such action as the local administrative committee shall deem proper in accordance with the National Industrial Recovery Act.

Section 14. Contractors shall submit bids including temporary work only when the quantities are distinctly stated, except on a cost plus basis. Maintenance and cost of current will be assumed only on a percentage basis.

Section 15. No contractor shall undertake to complete a contract upon which another contractor has temporarily stopped work because of non-payment of amounts properly due.

Section 16. Contractors shall at all times finance their own payrolls and accounts payable without assistance or guarantees of any sort from owners, builders or suppliers of electrical materials.

Section 17. The industry recommends that no contractor should offer unreasonable trade-in allowances, or assume unreasonable responsibilities with respect to guarantees of materials furnished or services performed.

Section 18. Provides for maintenance of terms of net price lists.

Sections 19 and 20. Refer to enforcement of public regulations and stipulate contract forms.

Article VI—Effective Date

This code shall become effective on the eighth day after its approval by the President of the United States, and shall be applicable to all work undertaken pursuant to contracts entered into or otherwise commenced after such approval date.

Figures of the Week

show:

Carloadings up 1.9 per cent.
Energy production again recedes.
Bituminous coal output turns upward.
Steel production tapers off further.
Lumber production reverses four-weeks decline.
Automobile output continues slump from peak of three weeks ago.
Security and commodity markets fluctuating with dollar exchange.
General business indexes continue declines.

Telltales of the week:

Federal reserve banks increase open-market purchases of government securities.
Roosevelt favors government loans to NRA industrial co-operators.
Montague Norman here to discuss the dollar and pound.
Control of price-to-consumer planned.
R. F. C. offers to loan at 5 per cent to aid manufacturers to pay processing taxes.
NRA plans unified policing of industrial control committees.

Coming Meetings

Pennsylvania Electric Association—Bedford Springs, Pa., September 6-8. A. B. Miller, Harrisburg, Pa.

Electrochemical Society—Chicago, Ill., September 7-9. Colin G. Fink, Columbia University, New York.

Rocky Mountain Electric Association—Santa Fe, N. M., September 11-13. George E. Lewis, Gas and Electric Bldg., Denver, Colo.

International Association of Electrical Inspectors—Chicago, Ill., September 11-14. V. H. Tousley, 612 No. Michigan Ave., Chicago.

National Electrical Exposition—New York, N. Y., September 20-30. Ralph Neumuller, 480 Lexington Ave., New York.

American Welding Society—Detroit, Mich., October 2-6. M. M. Kelly, 29 West 39th St., New York.

National Safety Congress, Public utilities section—Chicago, Ill., October 2-6. C. B. Boulet, Wisconsin. Public Service Corp., Milwaukee, Wis.

National Association of Railroad and Utilities Commissioners — Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

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Drumm Battery Train Establishes New Record

After serving for two years in experimental work the Drumm battery train, operating on the Great Southern Railway system in Ireland, has proved so successful that a further development has been made. Improving upon the earlier two-car unit seating 60-80 passengers and with a maximum speed of 47 m.p.h. on a level track, a new train with accommodations for 400 passengers was recently placed in service. This develops a speed of 50-55 m.p.h. and is reported to have a travelling radius, without recharging, of 120 miles.

Some battery features

The essential element of the trains, the Drumm storage battery, was described by Dr. Drumm at the World Power Conference in Stockholm recently. It is an alkaline battery with a discharge voltage about 50 per cent higher than alkaline batteries of the nickel iron type and an estimated useful life of ten years.

Even at high rates of charge and discharge the efficiency is high. The current or ampere-hour efficiency is typically 85-93 per cent, while the watt-hour efficiency may vary between 68 and 75 per cent. The cell unit of a 600-amp.-hour battery (standard size on the Great Southern Railway) shows an internal resistance of 0.00024 ohm at 25 deg. C. The resistance varies somewhat with the cell temperature, and at 0 deg. C. it becomes 0.00036 ohm, while at 38 deg. C. the resistance of the cell is 0.00018 ohm. Unlike the nickel iron cell the ampere-hour capacity of this battery is independent of cell temperature, and the Drumm battery will operate quite satisfactorily at 0 deg. C. On the other hand, unlike the lead cell, the ampere-hour or current capacity of the Drumm battery is independent of the rate of discharge; thus, the above train cell unit will furnish 600 amp. continuously for one hour or 900 amp. for 40 minutes, or 200 amp. for three hours.

The new battery cannot be damaged in any way by frequent overcharging or overdischarging. Neither can prolonged reversals of current through the battery, when discharging, cause any harm. The maximum cell temperature allowable is 45 deg. C.

The over-all dimensions of a 600-amp.-hour cell are: Length, 13.5 in.; breadth, 10 in.; height, 16.5 in.; weight, complete with electrolyte, 117 lb.; number of positive plates, 21; number of negative plates, 20.

The cell electrolyte consists of a solution of caustic potash of specific gravity 1.23, in which zinc oxide is dissolved until the specific gravity of the resultant zincate solution becomes 1.275.

The negative plates, of which there are twenty in a 600-amp.-hour cell, consist of a series of wires of pure nickel or nickel alloy clamped in a nickel plated iron grid. The sides of each grid are stoutly shod with ebonite.

The positive plates, of which there are 21 in each 600-amp.-hour cell, contain, as active material, nickel oxide, a substance which has already been in use in other alkaline batteries for a very long period. The nickel oxide is packed between layers of nickel flake in slender cylindrical tubes.

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Science Advisory Board to Guide Administration

President Roosevelt's Science Advisory Board, appointed to advise government departments and agencies regarding technical matters that may arise in emergency developments at Washington, held an organization meeting last week. Future meetings have not been scheduled.

Chairman of the board is Dr. Karl T. Compton, president of the Massachusetts Institute of Technology. Other members are: W. W. Campbell, president National Academy of Sciences; Isaiah Bowman, chairman National Research Council; Gano Dunn, president J. G. White Engineering Corporation; Frank B. Jewett, president Bell Telephone Laboratories; Charles F. Kettering, president General Motors Research Corporation; C. K. Leith, professor of geology University of Wisconsin; John C. Merriam, president Carnegie Institute; R. A. Millikan, director Norman Bridge Laboratory of Physics, California Institute of Technology.

The members of the board are appointed for two years. The organization has made no announcement regarding its proceedings.

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Insull Extradition Again Sought by U.S.A.

Undaunted by the failure of earlier efforts to secure Samuel Insull from the Greek government to answer various charges preferred against him in this country following the collapse of the "Insull Empire," the United States has again initiated extradition proceedings. At the request of federal authorities he is being held in Greece with a 60-day limit set, during which this country may bring about such action as it can to prove to Hellenic jurisprudence that its requests may be justified.

Federal indictment suppressed

The most recent move started with the returning of an indictment by a federal grand jury in the United States District Court for the Northern District of Illinois at Chicago on June 1, 1933, charging Samuel Insull, Samuel Insull, Jr., Martin J. Insull, Harold L. Stuart, Phillip J. McEnroe, John F. O'Keefe, Edward J. Doyle, John H. Gulick, Stanley Field, William R. Irwin and Charles W. Daniels with criminal violations of the national bankruptcy act. The indictment contains five counts, charging that the defendants unlawfully and fraudulently and with intent to defeat the operation of the bankruptcy act transferred and delivered certain property of the Corporation Securities Company of Chicago, an Insull concern, to various banks. The offenses are alleged to have been committed from November 2, 1931, until January 20, 1932. The United States District Court at Chicago ordered the indictment sealed pending the preparation of proper papers seeking the extradition of Samuel Insull in Greece.

Extradition papers were prepared and a formal request for the extradition of Samuel Insull from Greece was presented to the Department of State for submission through diplomatic channels to the Greek government. The department is informed that such request has been submitted by the American diplomatic officials to the Greek government.

The case is being handled for the Department of Justice, under the direction of Frank M. Parrish, special assistant to the Attorney-General. Dwight H. Green, the United States Attorney at Chicago, and Forest A. Harness, special assistant to the Attorney-General, located at Chicago, have been conducting the proceedings in that city. Mr. Harness, who sailed from this country on August 8, is now at Athens, cooperating with American diplomatic officials there in the extradition proceedings.

Hartford Electric Light Omits Customer Dividend

There will be no customers' dividend this year by the Hartford Electric Light Company. Last year, in perpetuating what has become a familiar policy on that property, the utility distributed more than $200,000 in the form of a 40 per cent credit on October bills. This year the uncertainty of future costs as a result of NRA co-operation led directors to omit their customary action.

"While it is hoped and expected that the existing improvement in the company's business will continue throughout the balance of the year to such an extent as to neutralize the increases in the company's expenses," an official statement said, "the fact remains that the situation for the remaining months of the year is uncertain."

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New England Commissioners Offer No Advice on Code

Following a conference late last week at the Massachusetts statehouse, public utility commissioners of the New England states released the following joint statement:

"The co-operation of the New England public utilities' regulatory bodies will be given the federal government in its efforts toward industrial recovery. The commissions feel, however, that they have no authority to advise or direct the utilities under their direction as to what attitude they should take."

Present at the conference were: Massachusetts—Henry C. Attwill, chairman; Everett E. Stone, Henry G. Wells, Leonard F. Hardy and A. C. Webber. Connecticut — Richard T. Higgins, chairman; Joseph W. Alsop and E. L. Taylor. Maine — Judge Albert J. Stearns, chairman. New Hampshire—Mayland H. Morse, chairman. Rhode Island—Judge William C. Bliss, chairman.

No further developments in the code situation have taken place. It is assumed that the New Hampshire opposition has been quieted since Chairman Morse joined the group in its statement. Opposition by regulatory authorities in other states is not heard. Several other properties have agreed to sign the submitted code. Hearings before NRA have not, however, been scheduled.

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Mississippi Properties Sold

Several Mississippi properties of the Mississippi Valley Utilities Corporation have been sold by order of federal court, Walter P. Armstrong being receiver and special master, to Edward G. Hotchkiss, trustee for the St. Louis Trust Company, the bondholders. The properties are located at Tupelo, Oxford, Holly Springs, Crenshaw, Charleston, Anguilla and Rolling Fork.

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Ohio Utility to Be Dissolved

Following the calling of its outstanding preference stock the United Ohio Utilities Company is to be dissolved, thus permitting the elimination of one of the subholding companies in the United Light & Power System. All of the outstanding common stock of the company is owned by the Columbus Railway, Power & Light Company. After the preference stock has been retired, all assets of United Ohio Utilities will be transferred directly to the Columbus company, which is a direct subsidiary of the Continental Gas & Electric Corporation, controlled in turn by the United Light & Railways Company, a subsidiary of United Light & Power.

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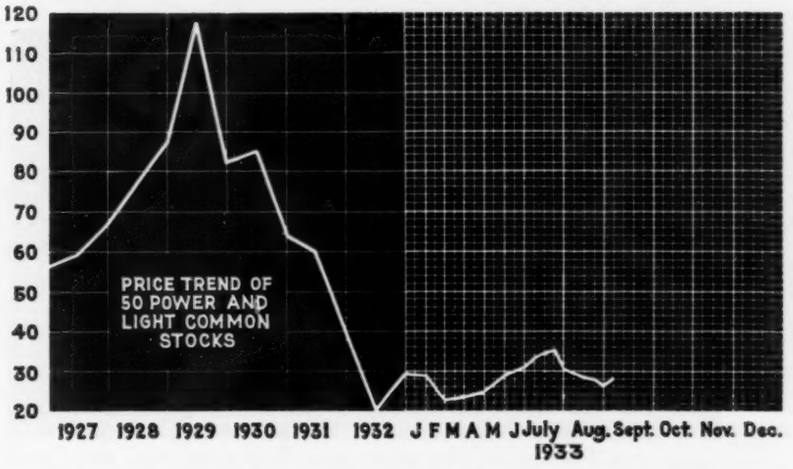
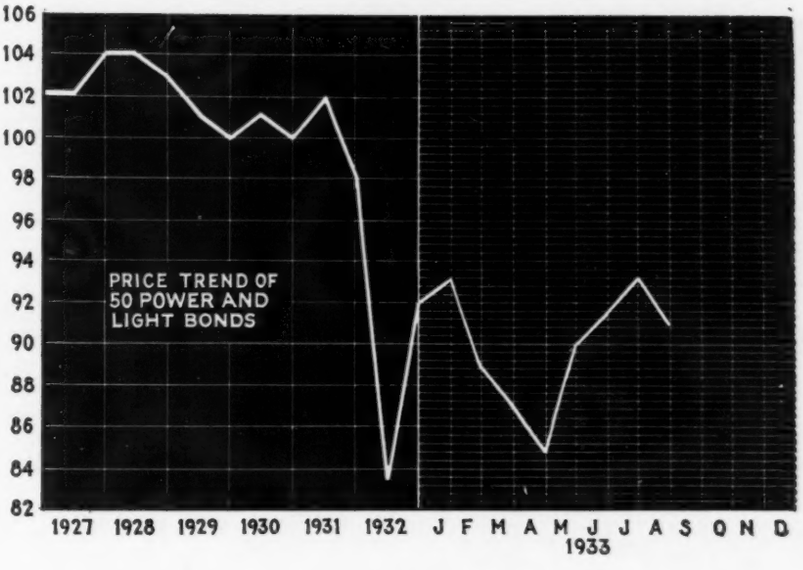
Lehman Utility Bills Killed

At the closing meeting of the extraordinary session of the New York State Legislature last week Governor Lehman's utility program (ELECTRICAL WORLD, August 12, page 195) was killed with the exception of one minor bill. This measure, requiring payment of interest on consumers' deposits, passed in the Legislature and has been signed.

Stocks Regain Ground; Bonds Off



Rallying along with the general list, the "Electrical World" electric utility stock average was 28.1 this week, 27.2 last. Light and power bonds declined in August, standing now at 91.0, against 93.4 early last month.



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Energy Output Shows Little Change

During the week ended August 26 the energy output of central stations declined a little over 1 per cent from the preceding week to a total of 1,630,394,000 kw.-hr., running contrary to the trend at this time last year. This decrease cut the gain over 1932 down to 13.5, as compared with a gain of 15.2 the previous week.

As indicated in the accompanying tables, based on weekly reports by the Edison Electric Institute, regional percentages are now available for the West Central and Rocky Mountain regions, not heretofore separately reported.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
Aug. 26.....	1,630	1,436	1,638	1,688
Aug. 19.....	1,650	1,432	1,643	1,691
Aug. 12.....	1,627	1,415	1,629	1,677
Aug. 5.....	1,650	1,427	1,643	1,692
July 29.....	1,662	1,440	1,644	1,678

Per Cent Change from Previous Year

	Week ended		
Region	Aug. 26	Aug. 19	Aug. 12
New England.....	+16.5	+18.7	+19.4
Middle Atlantic.....	+10.2	+ 9.9	+10.8
Central industrial.....	+18.2	+20.4	+21.0
West Central.....	+ 3.8	+ 4.2	.....
Southern States.....	+11.6	+18.1	+17.4
Rocky Mountain.....	+27.1	+26.9	.....
Pacific Coast.....	+ 5.9	+ 9.3	+ 6.8
United States.....	+13.5	+15.2	+15.0

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British Distribution Costs Analyzed by Engineers

Maintaining that in spite of ten years of intensive supervised development of electrical energy supply in Great Britain "little if any real improvement in the efficiency of distribution appears to have been achieved," J. M. Kennedy and D. M. Noakes of the Institution of Electrical Engineers have presented to that organization a report upon the history of distribution costs for electrical energy with recommendations for action to induce improvements.

As cited by the authors the situation in Great Britain, as of the present, is this: 57.7 per cent of capital invested devoted to distribution; generation capital, £20.4 per kilowatt of installed capacity; spare generating capacity in percentage of maximum demand, 83; percentage of revenue devoted to distribution, 51.1, and, domestic use of energy in percentage of total units sold, 30.3.

It is concluded that plans should be evolved for the co-ordination of generating facilities among British enterprises to eliminate the situation where the percentage of spare plant to maximum demand is higher than ever before. It is also recommended that distribution be organized in Britain to be placed in large areas under the control of single authorities rather than many. The commercial development of the national use of electrical energy is emphasized for its bearing upon prosperity, social well-being of the populace and generally better conditions.

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Grand Coulee Bids Opened

Bids on the $63,000,000 Coulee Dam project were opened by Secretary James O'Sullivan of the Columbia Basin Commission this week for work including core drilling and excavation for investigation of the Columbia River dam site. Between 2,500 to 21,700 ft. of 1⅜-in. diameter core drilling, 1,300 ft. in depth of test pits and 2,050 cu.yd. of open-trench excavation are involved.

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NRA Inspects Seattle Site

Presumably paving the way for an early decision on Seattle's application for an $18,500,000 City Light loan, the state advisory board of the NRA has inspected the Skagit hydro-electric project and surveyed the Diablo plant and the proposed Ruby dam and reservoir site, where it is proposed to do the development work.

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Italian Meter Rules Shifted to Promote Use

In order to facilitate an increase in the utilization of electrical energy the Italian Minister of Finance has authorized the use of a single-circuit service with one meter for both power and for light. Users must contract for five years with the electric company and the contract will involve estimates of the portion of energy to be used for lighting purposes, on which a tax is collected, and of the portion used for power for the operation of heaters, cookers, etc. These estimates will be made, for present customers, on the average yearly consumption increased by 10 per cent, and for new users upon the basis of similarity of conditions with present customers.

Italian electrical developments, so far as markets are concerned, have long been retarded by the previous ruling that separate circuits for light and power must be used with separate meters. A government tax, quite high, has been collected on energy used for lighting purposes.

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Rural Lines Now Serve More Than 700,000 Farms

An increase of 293 per cent in eight years in the number of farms receiving electric light and power service from private utility companies is indicated in a report just issued by the Rural Electric Service Committee of the late National Electric Light Association. As of April 30, 1932, the latest figures assembled, utility farm customers totaled 702,963.

It has been estimated by the Bureau of the Census that in April, 1930, 845,356 farms, or 13.5 per cent of the total in the United States, had electric service; of this number 249,342 had individual plants, while 596,014 had electric light and power company service. Based upon the Bureau of the Census definition of rural territory, which includes all areas outside of communities of more than 2,500 population, the total customers served in rural territory is approximately 4,000,000.

In the N.E.L.A. committee report California continues to lead with 86,548 farm customers. New York, Ohio, Pennsylvania, Wisconsin, Washington, Michigan, Iowa, Illinois and Indiana follow in the order named. Six states are credited with offering service to more than 50 per cent of their farms: California (63.8 per cent), Rhode Island, Utah, Massachusetts, Connecticut and Washington.

T.V.A. Announces Plans; Surveys at Norris Dam

Equipment has been moved to the site of Norris Dam preparatory to starting tests to determine the underlying nature of the earth where masonry construction will rise 250 ft. above bedrock. An exploration shaft measuring 6x9 ft. will be sunk on the west bank of the Clinch River at a point to reach bedrock at a depth of approximately 100 ft. In conjunction, two other tunnels will be bored into the opposite hill on which will rest the other end of the 2,000 ft. long gravity type barrier that will impound water for flood control and incidental power and navigation purposes. Arrangements have been made to carry on this work pending acquisition of land at the dam site by James W. Cooper, land attorney for the Authority. This preliminary job will consume about two weeks. There are 200 men conducting surveys in the locality pending acquisition of land for a town site as well as for the dam and reservoir. Land Attorney Cooper is doing the appraising.

The remains of early patriots now resting in pioneer burying grounds within the area to be flooded by the Norris Dam at Cove Creek will be transferred by the Tennessee Valley Authority. There are 4,260 historic graves in 92 cemeteries in the region, some of which date from Revolutionary and pre-Revolutionary times. At government expense, remains now in the reservoir area will be transferred to a new memorial cemetery, the site of which is to be selected by the Authority.

In an effort to combat destructive soil erosion in the Tennessee basin, the Authority plans this winter to reforest some 25,000 acres or more of denuded lands in the drainage area of the Clinch River. To carry out this project, the Authority has been offered the services of twenty-five Civilian Conservation Corps units with a total strength of approximately 5,000 men.

Civil Service requirements

The Authority announces that it will use the facilities of the United States Civil Service Commission in selecting its personnel on a merit basis closely comparable with the requirements prevailing in the federal Civil Service. The request of the Board of the Authority, directed to the Civil Service Commission, has been approved by the latter group. According to the terms of the approved arrangements, the facilities of the Civil Service Commission will be used to administer examinations to all non-professional applicants for employment, including skilled, unskilled and clerical groups.

Formal or informal applications for power service received by the T.V.A. to date involve more than 50 places in or near the sphere of development in Alabama, Georgia, Kentucky, Missouri, Mississippi and Tennessee.

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Boulder Dam Bids Placed by Three Generator Makers

Though three manufacturers have submitted bids for the initial installation of generators for the Boulder Dam power plant to the Reclamation Bureau, no contracts have yet been awarded. Bids covering three separate schedules were received, with the General Electric Company low on one, Westinghouse Electric & Manufacturing Company low on a second and Allis-Chalmers Manufacturing Company low on the third. The machines covered by schedules 1 and 2 will, it is said, be the largest ever manufactured. Complete bids follow:

Schedule 1—Two 82,500-kva. vertical shaft waterwheel generators complete, delivery based upon undertaking construction immediately: General Electric, $1,240,000; Allis-Chalmers, $1,270,000; Westinghouse, $1,285,000.

Schedule 2—Same as No. 1 except delivery to be within 550 days: Westinghouse, $1,285,000; General Electric, $1,327,500; Allis-Chalmers, $1,340,000.

Schedule 3—One 40,000-kva. vertical shaft waterwheel generator: Allis-Chalmers, $229,850; Westinghouse, $241,000; General Electric, $245,000.

This installation will comprise the first unit for the development of electric power at the dam and will make available for Los Angeles 300,000 kw., against 135,000 kw. now being used.

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Washing Machine Sales Gain

August orders received by the Maytag Company, manufacturer of washing machines, will be 50 per cent greater than any other month in the history of the concern, E. H. Maytag, president, has announced. Orders for a total of 50,000 were estimated for September 1. Almost 2,000 employees, working on two shifts, are engaged at the Newton factory, virtually double the number on the payroll three months ago and the largest in the company's history.

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Municipal Offer Countered

In connection with a municipal proposal to seek R. F. C. funds for construction of a $1,000,000 20,000-kw. generating plant at Red Mountain Bar, below Hetch Hetchy, Pacific Gas & Electric Company has submitted to the city of San Francisco a proposal to handle this power on the same terms as it is handling Hetch Hetchy power from Moccasin Creek power house, which is 4 mills per kilowatt.

Major New Construction This Week

Transformers, motors, controls, pumping machinery, conveyors, etc., will be installed in Trona, Calif., soda ash plant of American Potash & Chemical Corporation. A $1,000,000 project.

Kling Brewing Company, Detroit, Mich., to build $500,000 plant.

Fund of $650,000 being arranged by Menominee, Mich., for city-owned electric light and power plant, and plans authorized.

National Park Service, Department of Interior, Washington, D. C., arranging fund of $109,450 for extensions and improvements in electric transmission and distribution system in Yosemite National Park.

Motors, controls, transformers, regulators, conveyors, etc., will be installed in new plant of Fox Creek Distilleries, Inc., St. Louis, Mo. Cost about $125,000.

A $90,000 expansion and improvement program at city-owned light and power plant at Blue Earth, Minn., will include purchase of turbo-generator unit, power substation equipment, switchboard panels, boilers and accessories.

Department of Commerce, Bureau of Lighthouses, Washington, D. C., has secured appropriation of $76,500 for electrification and improvements in lighthouses and for electrifying coast lights in Washington.

Hamm Brewing Company, St. Paul, Minn., plans $85,000 expansion.

Substation equipment, motors, controls, regulators, conveyors, electric pumping machinery, etc., will be required by Santa Lucia Wineries, Inc., Fresno, Calif. Cost about $200,000.

Copeland Products Sold

Control of Copeland Products, Inc., has been acquired by Milton H. Morris for a purchase price not made public. The plant has been operating under a creditors' committee for several months and was offered for sale to satisfy a defaulted chattel mortgage for $460,000. Mr. Morris, who will head the business, represents Chicago and Philadelphia interests experienced in manufacturing and distribution of electric refrigerators, it was said. The business will continue without interruption at the present plant in Mount Clemens, Mich. The plant was sold at a private sale after bids received at the public offering were rejected.

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New York Metal Prices

	Aug. 22, 1933 Cents per Pound	Aug. 29, 1933 Cents per Pound
Copper, electrolytic	9.00	9.00
Lead, Am. S. & R. price	4.50	4.50
Antimony	6.875	6.875
Nickel ingot	35.00	35.00
Zinc, spot	5.22	5.12
Tin, Straits	44.375	45.35
Aluminum, 99 per cent	23.30	23.30

As to Rates—

• Union Electric Light & Power Company, St. Louis, has announced a voluntary reduction in electric rates amounting to $1,600,000 a year, to become effective November 1. Of the company's 309,000 customers, 289,000 will benefit by the reduced rate, which for some users will amount to 35 per cent. The average reduction, however, for the city and county is 17.5 per cent. The residential schedule in St. Louis eliminates the old counted room basis entirely and all domestic customers will pay on the same schedule regardless of the size of their homes. The proposed rates are to be for the first 32 kw.-hr. in any month 5 cents per kilowatt-hour, the next 168 kw.-hr. at 2.5 cents and all over 200 at 1.5 cents per kilowatt-hour with the customary 5 per cent reduction for prompt payment. The company will also give its customers the option of continuing on their old rates, if it is more favorable to them to do so. This provision is made to guard against any possible increase in bills under the new schedule for the same amount of electric energy in a month. Commercial lighting rates are also being adjusted downward. "This is the largest rate reduction we have ever made in our long history of voluntary reductions," Louis H. Egan, president of the company, said. "It is one of the largest ever made voluntarily or otherwise. Only a substantial increase over the present use of the service can justify us in making this extraordinary cut. We are, in fact, going squarely opposite to every present condition in reducing rates at this time. Production costs per unit have actually advanced since 1929, because of the decline in use. Other prices have now started up again, while taxes are absorbing an increasing proportion of the customer's payment to us each year. Electric rates in St. Louis are already very near the bottom for the entire country . . ."

• Detroit Edison Company's recent rate reduction, amounting to $1,500,000 (ELECTRICAL WORLD, August 26, page 264), failed to satisfy Commissioner Edward F. Fitzgerald, who, assailing his fellow commissioners for an action "that smacks strongly of dealing off the bottom of the deck," resumed his long-continued attacks. Replying to Chairman Clardy, who, in the majority opinion, signed by three members of the board, had berated Mr. Fitzgerald for his many public criticisms of the commission as a whole, Commissioner Fitzgerald said: "I think it apparent to every one who has followed the utility rate controversy in Lansing that had it not been for the arousing of public opinion through exposure of the pro-utility attitude of the majority of the commission, even the scanty relief provided for in the order (of August 14) would not have been obtained." He said that the Edison rate case is no different from scores of petitions from all parts of Michigan "which lie pigeonholed in the commission's offices" and which offer "irrefutable proof of the fact that the Michigan regulatory body has been a bulwark in defense of utilities against the efforts of consumers who have sought an easing of the utility rate burdens." One of the principal requests made by counsel for the city of Detroit was that the commission order an audit and appraisal of the company's property as a basis for a new rate schedule, which request was denied by the commission on the grounds that such action would cause delay and expense. Fitzgerald objected to this, too.

Following the earlier developments Detroit Edison Company announced that it would reduce rates voluntarily to an amount of at least $1,500,000 a year. This announcement followed the issuance of a temporary court order in Lansing restraining the Utilities Commission from enforcing its $1,500,000 rate cut order. The court order directs the Utilities Commission to show cause why the rate reduction should not be suspended or stayed until there is a final hearing of the case. It is returnable September 12. In the bill of complaint the Detroit Edison Company said that the reduction ordered is not based on an audit or appraisal which would show the need, if one exists, but on the alleged admission of Alex Dow, president of the company, in his testimony before the commission a year ago that rates to commercial users could be reduced $1,500,000. The company's filing of new rates will not be pursuant to the commission's order. There will be a succession of filings, the first of which will immediately help more than 30,000 consumers and apply to bills rendered October 1 for the preceding month's electricity.

• Public Service Electric & Gas Company's case covering rate reductions before the New Jersey Public Utilities Commission (ELECTRICAL WORLD, August 12, page 200) has been adjourned until September 14. The commission has ruled to hold in abeyance a motion by Thomas N. McCarter, Public Service president, to adjourn the hearing indefinitely. In supporting the motion for indefinite adjournment, ex-Senator Edmund W. Wakelee, a vice-president of Public Service, said: "We are starting on an uncharted sea. This is no time for us to be bothered, heckled or fussed with a formal rate hearing. It usually takes years and we probably will get nowhere."

• Northern States Power Company has been requested by Mayor John R. Serrin of Glenwood, Minn., appearing as chairman of a committee representing 45 central Minnesota cities served by that utility, for a general revision of rates. The 45 cities have joined in an organization known as the Central Minnesota Electric Rate Association.

• East St. Louis Light & Power Company and the Alton Light & Power Company have reduced rates to domestic consumers in East St. Louis and Alton following extensive negotiations with the Illinois Commerce Commission (ELECTRICAL WORLD, August 12, page 200). The rates for domestic consumers were reduced approximately $50,000 in Alton, or 23 per cent, and $70,000 in East St. Louis, or 16 per cent.

• Northern Indiana Power Company has offered Sullivan, Ind., a 10 per cent reduction in rates for electric service. The offer has been accepted and it is further agreed that if the Indiana Public Service Commission lowers rates below the accepted proposal, patrons will receive the benefit. The deal has nothing to do with street lights, however, Sullivan having been without them since January, when strict economy was deemed necessary after city funds became tied up in a defunct bank.

• Arkansas-Missouri Power Company has agreed with the Missouri Public Service Commission upon an 11 per cent reduction in electric rates for Kennett, Caruthersville and Hayti. The reduction became effective September 1.

• Hoosier Public Utility Company and the Indiana Public Service Commission have agreed upon a 12 per cent rate reduction for Greensburg, Ind., effective with September bills.

• Keokuk Electric Company will save consumers in Keokuk, Iowa, an estimated $27,700 a year in energy charges through rate reductions to be made effective October 1.

New York utilities act

• New York City electric light and power companies, subsidiaries of Consolidated Gas, acted quickly late last week to halt action by the New York Public Service Commission upon its $8,870,000 rate cut order (ELECTRICAL WORLD, August 26, page 259). Following the petition for a rehearing of the case proceedings were started in state courts to contest and review the rate orders made by the commission. Counsel for the companies presented their papers to Justice Schenck in the Albany Supreme Court and obtained the issuance of orders directing the Public Service Commission to show cause why temporary restraining orders and temporary injunctions should not be granted, pending final determination. The reduced rates will not go into effect until the motion for a temporary injunction is decided. Rehearings started.

George B. Cortelyou, president of the Consolidated Gas Company of New York, said:

"The electric companies of the Consolidated Gas Company System, in all their years of service to the public, have never before felt compelled to go to

court to resist changes ordered in their rates. The unwarranted order of the commission leaves us no alternative.

"We are presenting the matter to the courts of this state. Under the law, state court proceedings to review orders of the commission have to be brought in the Supreme Court for the third judicial department, in Albany, and our applications are made to that tribunal. We intend to review the orders of the commission before the Appellate Division for the third department, as authorized by law, and to bring the matter to the earliest possible decision. In no respect do we seek delay, but an adjudication as to the validity of the commission's action. We are advised that these orders are contrary to law."

"It looks like the fulfillment of the statement I made at that first hearing," said Chairman Maltbie of the commission when informed of the company's action. "Then I said that the companies can tie this up for a long time if they do not wish to co-operate and that they can make our efforts fruitless."

• Yonkers Electric Light & Power Company, which was excluded in the New York Public Service Commission's order lowering rates in the metropolitan area of New York (ELECTRICAL WORLD, August 26, page 259), may have its case reopened if the commission grants the petition filed by Leonard G. McAneny, corporation counsel, requesting a rehearing.

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Fellowships for British Engineers

Trustees of the will of the late Lord Leverhulme have decided to devote approximately $60,000 a year to establish several Research Fellowships intended for the assistance of experienced workers rather than to add to the provision already existing for workers in the early stages of their careers. Among those selected by the advisory committee for fellowships are: C. R. Burch, B.A., physicist of the Metropolitan Vickers Electrical Company, who will undertake research on "the production of aspherical optical surfaces and on their imaging properties in combination," and H. S. Hatfield, Ph.D., who will investigate "the behavior of crystalline substances in electric and magnetic fields." Dr. Hatfield's research will be concerned with the effects which are obtained when currents are used in certain processes.

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Kansas Tax Shift

Though an increase of 0.55 mill over the 1.88 mills state tax levy for general purposes in 1932 has been announced for 1933, valuations have been reduced by an average 16 per cent. public utilities, according to C. C. Cogswell of the Kansas State Tax Commission, are not expected to pay much, if any, more in taxes in 1933 than in 1932.

Municipal Items

O'FALLON, ILL.—In a poll taken by house-to-house canvass, at the instigation of the City Council, citizens have indicated their approval of the construction of a municipal electric light and power plant by a vote of 783 to 4. The move for municipal ownership follows dissatisfaction over the failure of the Illinois Power & Light Company, which now serves the city, to reduce its rates (ELECTRICAL WORLD, August 12, page 201).

WISCONSIN—Threat of the Wisconsin Power & Light Corporation to take any legal steps that might be necessary to prevent the construction of a municipal plant in Beloit (ELECTRICAL WORLD, July 29, page 136) has materialized with the filing of injunction suits in the Circuit Court at Janesville, naming city officials and members of the Council as defendants. The two cases, substantially the same in effect, differ somewhat in form to comply with legal technicalities. The petitions allege that the city has already authorized the issuing of $133,000 in municipal bonds and has advertised them for sale. The utility contends that the city has no authority to issue the bonds for this purpose, and alleges that they will, if issued, be void, and says that the city has no authority to construct, maintain or operate a plant of the type contemplated. The petitions also charge that a contract has been entered into with the Fairbanks, Morse Company in Beloit to furnish equipment without calling for bonds in the usual manner. The legality of this action is at stake.

Plans for purchase of the Wisconsin Power & Light Company equipment in Edgerton have been made at a recent meeting of the City Council following decision of the voters in the spring election to purchase the equipment.

Pardeeville residents have voted 237 to 53 in favor of purchasing the property of the Pardeeville Power & Light Company. The Public Service Commission will be requested to determine the value of the property. If the value set is satisfactory to the company and village a bond issue will be floated and the purchase completed. If the value is not suitable to both parties the appraisal can be appealed to the Dane County Circuit Court for decision.

Citizens of McFarland have petitioned the Public Service Commission to place a price on the distribution system of the Wisconsin Power & Light Company in that village to permit purchase of the plant for a municipal undertaking. A hearing on the petition will be held September 11.

ALTON, ILL., through the action of the City Council, has appointed a special commission to study the public ownership of local electric light and power, gas and water works for the city. It has been estimated that this would be a $1,200,000 project.

UNION CITY, IND., and OHIO, divided by the line between states, consists of two separate corporations, one Mayor. The city is divided also on light and power problems. West Siders (Indiana) declare that if the east side (Ohio) builds the electric and water plants the action will blast efforts to bring about a closer relationship between the two municipalities. The west side supports two factions, one favoring a loan of $45,000 to electrify the present water works plant and eventually construct a municipally owned electric plant. The other maintains that the present steam plant can be put in condition to operate efficiently for many years and has taken legal steps to block the proposed electrification of the water plant. Mayor Gist is a champion of municipally owned plants. The city is served by the Public Service Company of Indiana and Union City Electric Company, Midland United subsidiaries.

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Utilities Ask Review of Tax Claim

Eight subsidiaries of the People's Light & Power Company, now in receivership, filed identical petitions last week with the Board of Tax Appeals in Washington for reviews of a government claim of $213,616 in 1930 income taxes. Another subsidiary, the Western States Utilities Company of Portland, Ore., previously filed a similar petition. Petitions were received from the West Coast Power Company and the California Public Service Company of Portland Ore.; Texas Public Service Company of Austin, Tex.; Kansas Public Service Company of Lawrence, Kan.; McCamey Sewer Company of Texas, Pinnacles Development Company of Virginia, Employees Investment Corporation of Delaware and Iowa Water Service Company of Iowa City.

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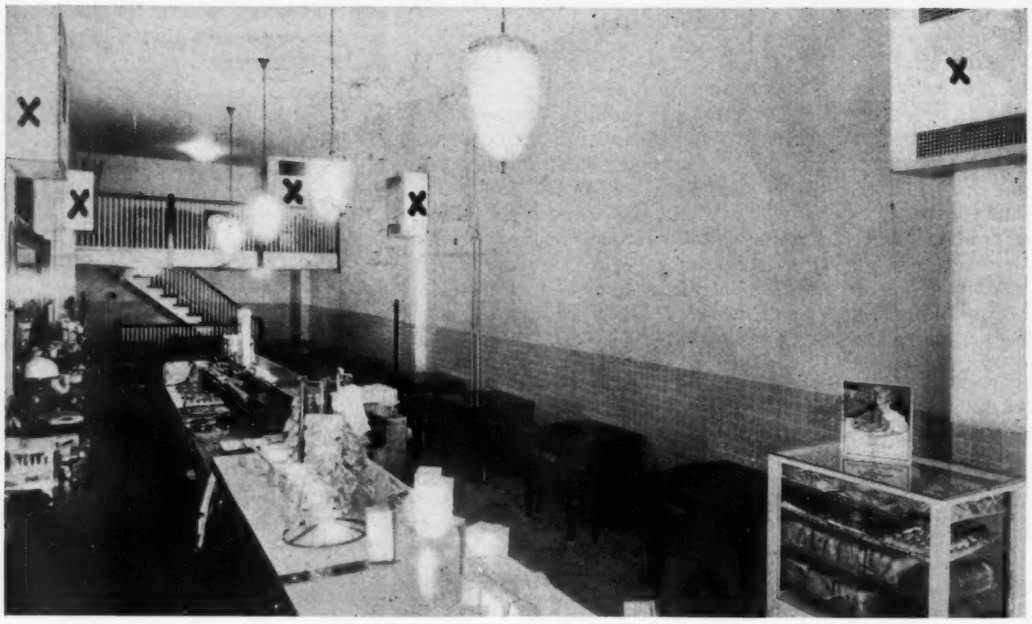
To Check California Program

Referendum proceedings are being initiated against the $170,000,000 California statewide water development program recently approved by the state legislature (ELECTRICAL WORLD, August 5, page 165). Petitions have been submitted to the state Attorney-General's office for titling and are to be circulated throughout the state. Included in the program are a 320,000-kw. hydro-electric plant and a $10,000,000 high-tension transmission line from Kennett, on the Sacramento River, to the San Francisco Bay region. The state is seeking funds for the construction of the project from the Public Works Administration, intending to make repayment from revenues derived from the sale of power.



Air-conditioning units staggered along opposite walls at 10-ft. level

Air Conditioning Sells

By J. P. MINNICH

Metropolitan Edison Company, Reading, Pa.

Unit applications found best for utility promotion.
Individual application in Metropolitan Edison Company.
How to sell and install air conditioning.

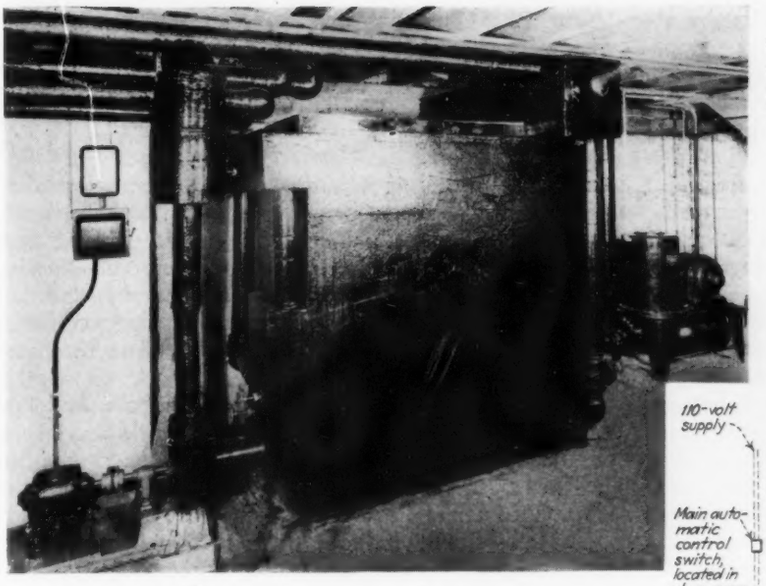
APPLICATIONS of air conditioning in the territory of the Metropolitan Edison Company began, as they have in most power company territories, with the larger theaters. Four of these theater installations were of the central system type, using mechanical refrigeration and one using well water. This latter installation was intended to be a mechanical refrigerated job, but the cost of city water to be used for condensing caused the owners to drill a well. The well brought in such an ample supply of water at a summer temperature of 55 deg. that it was considered unnecessary to install the compressor unit. The plant consists of an air washing and circulating system and accomplishes results comparable to those of the mechanically refrigerated installations.

In the plant of the P. H. Gladfelter Company, Spring Grove, Pa., maker of book and bond papers, the air-conditioning equipment has been installed in three finishing rooms, one of which is 150x150x18 ft., in which there is a No. 6½ Sirocco fan driven by a 7½ hp. motor and a 2-in. water pump driven by a 3-hp. motor. Another room 140x140x22 ft. has a 15-hp. fan and 10-hp. pump. A third room 250x110x22 ft. has similar equipment. This customer reports the following results from this installation:

"The temperature and relative humidity can be controlled within a very satisfactory range. Controls are set for 72 deg. F. temperature and 48 per cent relative humidity. Benefits from this installation may be classified as comfortable and healthful working conditions, a uniform product as to moisture content and reduced cost of maintenance to building because of reduced alternating wet and dry conditions."

The advantages of air conditioning in printing establishments are becoming well known, and this modern idea, along with high intensity and flood lighting, and other improvements, was incorporated in the new plant of the Mack Printing Company, Easton, Pa., printer of leading technical and trade journals. In this installation was noted the trend toward localized or unit air conditioning. Instead of a central conditioning plant, six units using 5 hp. each are located in important departments and the conditioned air is distributed through short ducts of small dimensions. During the winter the air is passed over steam coils, thermostatically controlled. Provision is made for partial recirculation of air. A water vaporizer in each conditioner is controlled by a hygrostat, which maintains a constant moisture content in the air circulated in the building. This spray of water serves to add moisture to the air in winter and to remove moisture from the air in summer.

The advantages of air conditioning in this plant have to do principally with the improvement in the performance of the paper going through the presses. The presence of the right amount of moisture (particularly in winter) eliminates static from the sheets. In summer offsetting of the printed sheets is eliminated as a result of the quicker setting of the ink in the drier atmosphere that is maintained by the conditioning equipment. Control of moisture effects an economy by permitting the use of thinner paper. Even thick paper becomes brittle, cracks



Cooling tank and circulating pump to supply four units in the lunchroom

and loses strength in the extremely dry air of winter. With moisture under control thinner paper gives entirely satisfactory results. The moisture in the air opens the fibers of the paper and causes the ink to be absorbed more readily. It also causes the ink to spread economically and to give a clear impression, with no ink pulling. Ink flying is eliminated, reducing slippage between presses. Paper flying is held down, avoiding clogging of the press machine parts. This elimination of ink and paper flying is a hygienic improvement as it prevents contamination of the air in the pressroom. The control of proper moisture content of the air in winter reduces the amount of fuel required for building heating.

As a result of the air-conditioning installation in this plant positive economies in the use of ink, paper and fuel have been realized, working conditions have been improved and the productiveness of labor has been raised.

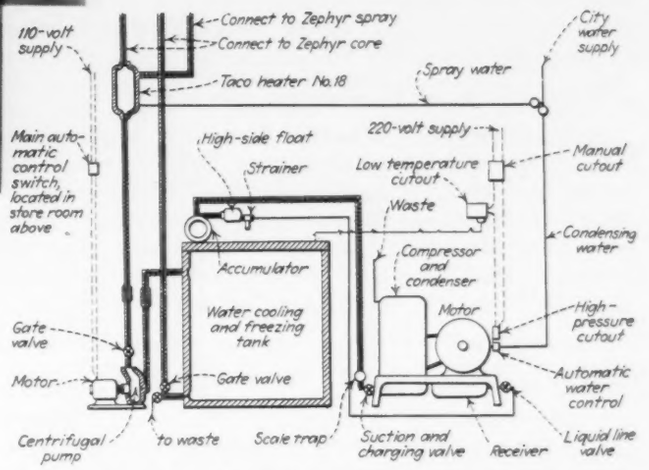
Air-Conditioning Installations by the Power Sales Department

in the Pennsylvania-New Jersey Territory of the Associated Gas & Electric System

	Division	Service	Use	Connected Load Hp.	Estimated Annual Revenue
Capitol Theater	Reading	Commercial	Comfort cooling	302½	$3,000
Colonial Theater	Reading	Commercial	Comfort cooling	245	3,000
Embassy Theater	Reading	Commercial	Comfort cooling	115	2,000
E. Richard Meinig*	Reading	Industrial	Office	½	75
Oakbrook Hosiery Mills*	Reading	Industrial	Office	1½	75
Zipf's candy store*	Reading	Commercial	Product and comfort	¾	75
St. Lawrence Dairy Lunch*	Reading	Commercial	Comfort cooling	5	300
Abraham Lincoln Hotel*	Reading	Commercial	Comfort cooling	7½	200
Barbara Ann Tearoom*	Reading	Commercial	Comfort cooling	3½	250
Henninger Funeral Home*	Reading	Commercial	Comfort cooling	1½	100
Mother Hubbard Candy Company*	Reading	Industrial	Process	10	500
Luden, Inc	Reading	Industrial	Process	450	6,000
P. H. Gladfelter Company	York	Industrial	Process	60	1,000
Mack Printing Company	Easton	Industrial	Process	30	800
State Theater	Easton	Commercial	Comfort cooling	200	950
Embassy Theater	Easton	Commercial	Comfort cooling	125	1,250
Riegel Paper Corporation	Easton	Industrial	Process	20	500
Total				1,577	$20,075

*Installed in 1932.

Arrangement of air-conditioning equipment in basement of lunchroom



In a soda fountain and lunchroom 60x14x15 ft. 7 in. the St. Lawrence Dairies has installed a unique system of air conditioning combining localized control of distribution with a central cooling plant. The size and height of the room presented the problem first of sufficient delivery points to maintain an even distribution of the cooled air and the economic necessity of keeping this cooled air down at the living level and not attempting to cool the entire room volume. To accomplish this four "Zephyr" units, each with a capacity for utilizing one ton of refrigeration and delivering 280 cu.ft. per minute, were hung on opposite walls and staggered to give the best distribution. The outlets were located 10 ft. above the floor line and set to deliver horizontally across the room, with the result that the cooled air always remains below the 10-ft. level and is kept in constant circulation.

The four units are connected by water lines to a 50-g.p.m. centrifugal pump located in the basement, which in turn is directly connected to a water-cooling and ice-freezing tank. This tank is probably the most interesting part of the entire installation as it is designed to store up refrigerating capacity during the time that cooling is not required in the store. This is accomplished with a 36,000-B.t.u. Carbondale compressor thermostatically controlled from the tank. With a setting of 30 deg. F., the compressor will store up approximately 2,000 lb. of ice during the night when cooling is not required. This ice is then available the following day and, in conjunction with the compressor, gives the cooling units an adequate supply of cold water to meet any demand. Here is an interesting use of the thermal capacity of ice for supplying peak loads on a mechanically operated air-conditioning plant. In this installation the ice is made on the spot and during off-peak hours, a combination that would compete with a very low cost of delivered ice.

The temperature in the lunchroom is controlled by a thermostat which starts and stops the circulating pump in the basement. Inasmuch as there is always an adequate supply of cold water in the cooling tank there is no time delay in delivering the cooled air to satisfy the thermostatic setting.

The entire system as installed is highly flexible throughout its operating range, distributes its power load throughout the 24 hours of the day, is efficient because of its ability to keep the cooled air at the living level and maintains an air condition within the limits of the "comfort zone" as prescribed by the American Society of Heating and Ventilating Engineers. This installation duplicates on a small scale the performance of the large theater plants, with perhaps an even higher load factor on the power company's lines.

Unit air conditioners gain in use

In the industrial plant of E. Richard Meinig, operating a compressor for providing cool drinking water, the owner was induced to install a Carrier-York unit consisting of a cooling coil, mechanical air filter and a circulating fan. This unit, installed in the office, is connected to the drinking water supply and the office is made very comfortable during the hot weather days.

Using the above installation as a steppingstone, the owner of a silk mill was induced to install a similar air-conditioning unit, the cooling coil in this unit being served from a small compressor using the new F-12 refrigerant and cooling by direct expansion.

In a candy store the Carrier-York Company installed a portable ice-melting cabinet on trial, where considerable candy had been spoiled as a result of bad air conditions. The results obtained from the ice-melting unit were satisfactory, but the customer did not like the inconvenience of icing the unit and has now installed a Carrier-York air-conditioning unit operating on direct expansion from a small compressor located in the basement.

The barber shop in the Abraham Lincoln Hotel is located adjacent to the boiler room and has always been extremely uncomfortable during the summer months. The power salesman had called this condition to the attention of the hotel operators for a period of some months and finally induced them to install a comfort-cooling plant. The success of the barber shop installation encouraged the hotel to adopt unit coolers for the coffee shop as well.

Six Frigidaire conditioning units have been installed, two in the barber shop and four in the coffee shop;

Dow Uses the Papers

TO HIS 500,000 customers in 29 cities, 58 villages and 130 townships Alex Dow, president of Detroit Edison Company, has been addressing letters in the newspaper columns to tell them of rates, service, utility plant facilities, freedom from holding company dictation and taxes, especially taxes. In one of the final ones, closing a series of 40 over an eight weeks' period, he says:

"From letters received we have learned things that some of you, our customers, want to know . . . quite a few of you have been believing things that were not so. Others did not know some very simple things that we

About coal. Some of the talk about rate reduction has been based on the point that coal is cheap. Well, coal is cheaper than it was in 1929, but not a great deal cheaper. We paid 32 cents less per ton for coal in the year 1932 than in 1929. However, because of fixed cost, coal only assumes major importance when service is used long hours. To the customer who uses his service only a few hours a day it is a small item. To the domestic customer the difference in coal cost between 1929 and 1932 is less than a cent and a half a month. Seventeen very large customers use so much current that coal is one of the controlling costs and they pay for their service at a rate that varies with the cost of coal.

An electric utility has certain big costs which cannot be scaled down in proportion to the drop in business. One of these is taxes. We have to pay taxes whether we sell electricity or not.

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The Detroit Edison Company is the largest taxpayer in Detroit. We are all taxpayers, directly or indirectly, so we're all in the same boat. You customers pay our taxes. There is no other way of our earning them.

The big increase in taxes has hit us especially hard. During the last twenty-five years our annual tax bill has jumped more than fiftyfold. In 1932 we paid out $5,699,000 in taxes. That's a lot of money even in good times—and it's more than we paid in 1929 when we were selling much more electricity. In 1920 a little over 5 cents of every dollar we earned was paid out for taxes, but it's been climbing steadily until last year, when it jumped to almost 13 cents. For every two dollars in wages we paid our operating employees last year we had to pay one dollar in taxes.

The biggest share of our total tax bill went into the coffers of the city government of Detroit. Last year we paid 4 per cent of the total taxes assessed by Detroit. This was 7.5 per cent of the total taxes actually collected by the city during 1931.

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We want you to understand that we are a business concern, having our troubles in business just as you have yours. Some people seem to think that we have a hidden gold mine, and when people do not pay us for service, or keep us waiting for ages, or when some taxing authority raises our taxes out of reason, that we have only to dig and smelt some more of the golden ore. It is not so. Your business with us is all the business we have. We are taxed, you in turn pay us the taxes, and we pass the tax money along to the tax-gatherer.

Maybe you feel better to pay taxes through us, but we guess not. We do not feel at all honored by being used as tax collectors, and being blamed for costs to you which we neither make nor control.

We have already told you that taxes take nearly 13 cents out of every dollar which we charge to you. This has nothing to do with the 3 cents on the dollar which some of you are paying through us to the United States government. That 3 cents is just another 3 cents on top of the 12.9 cents. There is some talk in Congress about taking that 3 cents off the customers and putting it onto the companies—which will not make any difference. We have to get it out of our earnings, and it is you who pay us the earnings.

There are two serious questions on our minds just now about taxes. The first is whether they are not entirely too heavy on the people who pay them, either directly or indirectly. Do the people get value for them? The second is that when a municipality, served by us at the same rates as other municipalities, undertakes to load extra taxes and charges upon us, it is a question whether we can justly spread those charges over all the municipalities which we serve. Instead of having uniform rates over all our served districts, we may under the law have to raise the rates where excessive taxes are assessed.

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Some of our friends think the power house, with its boilers and turbines and electric generators, is pretty much the whole show. It is not so. The power plant is seldom one-third of the system. All of

these units operate on the refrigerant F-12 and cooling is accomplished by direct expansion. The barber shop and coffee shop now boast spring-like weather summer and winter.

Developing the market

With close supervision customers can be induced to increase the perfection of their air-conditioning installations. Power salesmen of the Metropolitan Edison Company recognize that it is desirable to make each air-conditioning installation as complete and as nearly perfect as possible. They believe, however, that the industry should not wait for perfection, but use what equipment is available and as much as the customer is willing to pay for as a start, and then by close supervision and education lead him to perfect his installation and to obtain all of the services which a complete job provides. These include:

For Summer Months—Dehumidification, lower temperature, clean air and adequate air distribution.
For Winter Months—Humidification, proper temperature, clean air and adequate air distribution.

Every prospect will not be willing to spend the money to do all of these necessary and desirable things, but since the improvement of any one of these elements will be pleasing, the results should encourage him to boost the general idea of air conditioning. Every advance based on sound engineering is, in our opinion, a step ahead and helps to popularize the idea that clean air, properly conditioned and under control, is the last word in modernization and that manufactured weather is not only talked about but praised.

Air-conditioning exhibit

Encouraged by the success of the growing list of installations in its territory, the Metropolitan Edison Company sponsored an air-conditioning exhibit in co-operation with the Electric League and manufacturers of equipment. Invitations, followed by personal calls of dealer and power and lighting salesmen, were sent to doctors, dentists, beauty parlors, restaurants, barbers, soda fountains, candy stores and architects. Prospective home builders and speculative builders were also invited to attend.

The exhibit, held in the Electrical League headquarters, was arranged to show equipment for proper conditioning the air in an office, a living room, a store and a central house heating plant. One representative of each dealer and manufacturer of equipment displayed was allowed on the floor. In addition, guides and attendants were furnished to welcome and escort visitors through the exhibit.

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to Expose the Tax Evil

supposed you did know and that you should know.

"You are indirectly being taxed about three times as much on your electric service as you were taxed ten years ago. You may presently be taxed still more. Taxing the company means taxing the company's customers. If you absorb these facts, these advertisements will have been justified."

Samples and extracts from some of the letters are appended as an example of what one executive conceives to be his way of meeting the call for more exposition about the "mysteries of the utility business":

our power plants, steam and water, cost about a third of the whole.

It would be too long a story if we listed and explained every part that is needed to have your electric service ready to be switched on as you need it. And the cost of making the power at the power house is just a shadow less than the taxes that we are required to pay—or, rather, that we are required to collect from you.

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When you get a bill for city or state taxes, or when you fill out your income tax blank for the United States Treasury, you know you are being taxed. When you paid your electric light bills since 1920, you did not know that you were paying added taxes, from 5 cents out of each dollar in 1920, up to 13½ cents on the dollar this year. The taxes were there just the same, and we want you to know it. We might have told you sooner, but we kept hoping for the end of the increase of burden. We are going to remind you of it hereafter. And this is not a story about any new special tax, like the 3-cent United States tax. It is about the taxes that have been paid right along.

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An indirect tax affects all of you. It makes a tax-gatherer of your electric company. You blame the company if you think your bill is too high. You never think that the increase of taxes since 1920 has added 8 cents on the dollar to your electric bill. To be exact about it, your electric bill would have been lower by 8 cents on the dollar if the total taxes on the company had been fixed at the 1920 figure.

Nowadays there is talk about taking this or that or the other tax off the consumer and putting it on the electric company. Do not be fooled by that. The only place we can get our year's taxes is out of our year's sales to you.

It looks easy to tax the electric company. To do so changes the place for a few days, but it does not change the pain, and you pay just the same in the long run.

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We have never made a campaign against high taxes. We have no wish to make one now. Our tax is supposed to be assessed on the same rule as that of other taxpayers.

But we may find ourselves in the place where fairness to you will require us to join in such a campaign. If that comes about we will want you to understand it is your pocketbook we are protecting, and we ask you to keep that statement in mind.

The Detroit Edison Company pays eight-tenths of its city and state taxes on personal property and only two-tenths on real estate. It makes a full disclosure of its property which is taxable as "personal." Do all other taxpayers do this? That question will need some answering if we are compelled to ask it.

It is time to say some more about taxes. There is no place for us to get money for a year's taxes except out of a year's sales of service to you. Now please look at this showing of how much tax money was taken out of each dollar you paid us in recent years:

Year	Taxes Out of Each Dollar Paid to Us, Cents	Remaining to Us Out of Each Dollar Paid by You, Cents
1920	5.1	94.9
1921	6.5	93.5
1922	6.5	93.5
1923	6.8	93.2
1924	7.7	92.3
1925	8.0	92.0
1926	9.0	91.0
1927	9.7	90.3
1928	9.8	90.2
1929	9.6	90.4
1930	10.7	89.3
1931	11.7	88.3
1932	12.9	87.1
12 months to April 1933	13.5	86.5

(3 per cent U. S. tax is additional to these figures.)

Our rate to you was less, because we made reductions of rates. What we got for our service was still less, because the amount taken for taxes out of each dollar you paid us was constantly more. If the taxes were back to the 1920 proportion you could have lower electric rates.

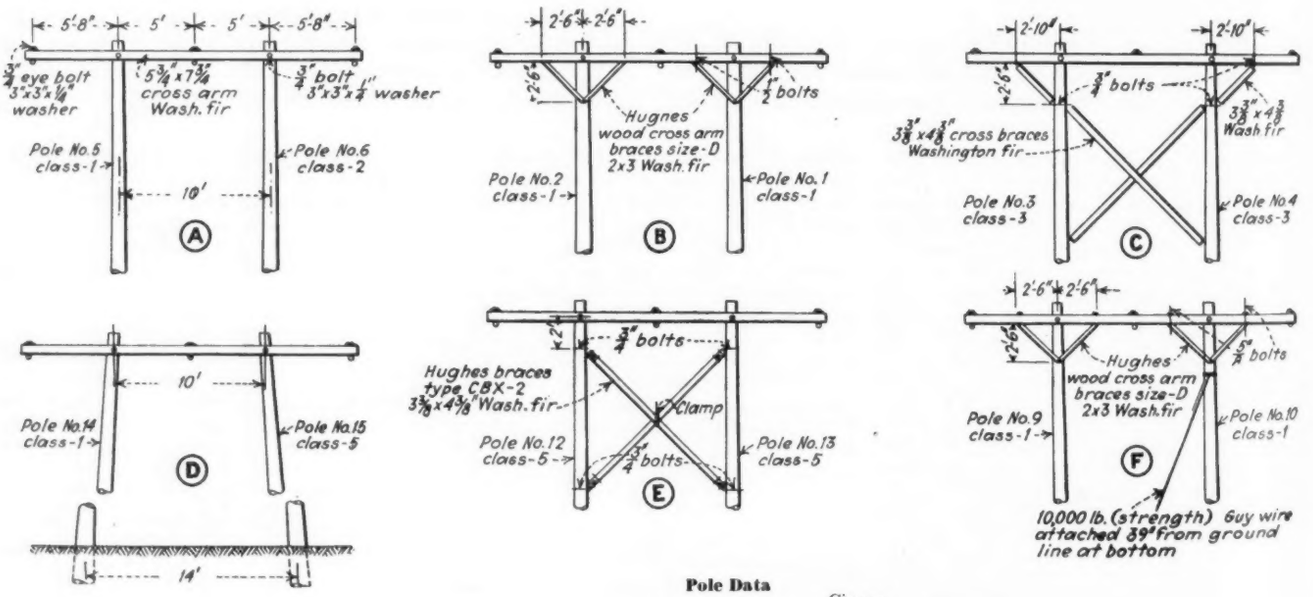
Tests Demonstrate Value of X-Braced H-Frames

MANY times serious difficulties are encountered in obtaining right-of-way for side guying H-frame structures. If wood braces could be substituted, giving the required strength and eliminating right-of-way difficulties, Hughes Brothers of Seward, Neb., felt that a large saving would be effected in labor, material and right-of-way expense. To obtain definite information on various schemes of bracing they, with the assistance of the Iowa-Nebraska Light & Power Company, conducted a series of tests, some results of which are presented in Table I.

The poles used in all of the tests were Western red cedar, ½-in. guaranteed Pentrex treated, taken from the stock of the utility company, and were of measurements and class shown in data. The remaining material was taken from Hughes Brothers stock. The crossarms were all 5¾ x 7¾ in. x 22 ft. Washington fir. The arm braces were standard size "D" and the "XX" braces CBX-2, except where modifications are indicated in the drawings or comments. Vertical loading was obtained by use of a flexible steel beam loaded to 2,250 lb., this being equivalent to ½ in. radial ice loading on three No. 4/0 A.C.S.R. wires strung in 575-ft. spans. Transverse loading was obtained by use of a power winch, as indicated. It was felt that this method duplicated actual operating conditions very closely, as the conductors stood at approximately the same angle at the time of maximum load or structure failure as those of actual field failures, checked by photographs and observations of the various engineers witnessing the test.

As a result of these tests and subsequent studies, comparing the strengths of cross-braced and unbraced H-frames, using different classes of poles and separations, Hughes Brothers reached the following conclusions:

Cross bracing of H-frames with wood members is not only a means of reducing the investment in transmission lines because lower class poles can be used to get the same strength, but where



Pole Data

Pole No.	Length Ft.	In.	Class	Circumference Top. In.	Circumference Butt. In.	Circumference Ground Line, In.	Theoretical M R Ground Line. Ft.-Lb.
1	40	4	1	33	50	47	153,492
2	40	4	1	29	51	46	143,900
3	40	4	3	27	42	40	94,617
4	40	0	3	26	48	39	87,697
5	40	4	1	31	56	48	163,499
6	40	4	2	29	44	43	117,543
7	40	0	3	30.5	44	42	109,530
8	40	4	2	28.5	48.5	45.5	139,259
9	40	4	1	29.5	53	44.5	130,278
10	39	9	1	28	53.5	50	184,800
12	40	0	5	28	42	34.5	60,707
13	40	0	5	25	44	35	63,386
14	40	4	1	31	47.5	45	134,719
15	40	0	5	28	44	36	68,976

Structure A was tested to serve as a basis of comparison. Characteristics of the poles, which were ⅛-in. Pentrex treated, are given in the table. The crossarm, hardware thereon, separation of poles and spacing of conductor attachment were the same in all cases as in structure A, except where indicated otherwise.

Fig. 1—Some of the structures tested for strength and deflection

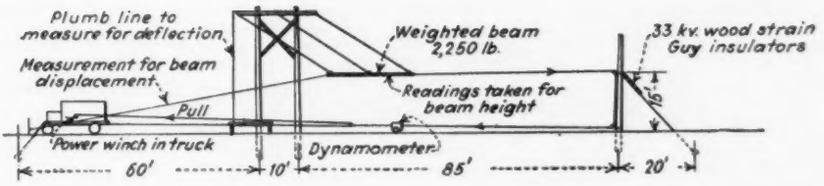


Fig. 2—Method of applying horizontal and vertical loadings to simulate service conditions

A slightly different arrangement was used in the first three tests, but was abandoned in favor of this.

guys have been used in the past on this type structure a great saving in right-of-way required is accomplished. The initial cost of these braces as compared to guys, in many instances, is considerably less. The impulse flashover difficulties encountered by the use of metal guys is entirely eliminated. A much stronger line with less maintenance or operating costs is thereby obtained.

Some observations regarding the individual tests summarized in Table I follow:

Observations on tests of structures

(A) The crossarm tended to bow down at ends. Pole 6 failed first, fracturing diagonally from ground line to several feet above; pole 5 broke at ground line.

(B) Failure of the poles followed immediately after a ½-in. brace bolt through the arm failed in shear, throwing the added transverse load to the poles. Advantage was taken of this experience to substitute ⅝-in. bolts in structure F. An improvement of 26 per cent was obtained over structure A, but it was felt that the ultimate possibilities of this type of bracing were not reached. It is believed that the improvement in strength results from the braces tending to fix the position of the upper ends of the poles, giving the improvement in resisting moment found in a beam fixed at one end with the other end free but guided, over that obtained in a simple cantilever beam.

Pole 1 broke first, failing at the ground line; pole 2 failed several feet above ground. The failure of pole 1, which was caused by the combined vertical and horizontal loads, resulted in the fiber stress shown in the table. Considering deductions in strength based on improper incision, this checks with the value which would be expected.

(C) The arm braces are similar to, but heavier than, those used in structure B. Poles of lower class were used to prove or disprove whether additional structure strength could be obtained with lower class poles and braces, compared with larger unbraced poles. The results indicated this to be true. The compression brace buckled at maximum load, indicating the desirability of using some form of clamp to reduce the unsupported length of brace. Investigation of the braces also indicated that two bolts on the end fittings were not sufficient to hold the loads transmitted through the braces. Improved designs involving both of these features were incorporated in later tests. This structure showed an improvement of 139 per cent over structure B, but did not represent the ultimate possibilities as the poles themselves did not seem near failure at the time the brace broke.

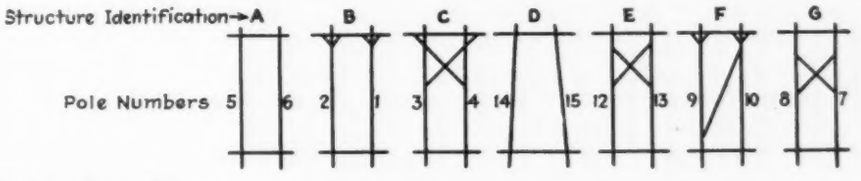
Observation during the test indicated that when crossarms of sufficient safety factor are used the value of short crossarm braces is questionable when used in connection with "X" braces.

(D) This structure was constructed to prove or disprove the value of raking the poles of an H-frame to get better transverse strength. The results indicate that no improvement in strength was obtained; in fact, this raking is a disadvantage, as the back pole (14) is subjected to a bending moment not only from the transverse load but from vertical conductor load as well, due to its angular position, whereas the near pole (15) is nearer upright at time of maximum load and acts more as a column. The resisting moment of the two poles cannot be added to obtain total strength, as the load is not divided evenly under transverse loading.

Both poles broke at ground line; pole 14 failed first. The use of poles of large difference in ground line circumference is questionable. Due to this variance, pole 14 assumed 2,840 lb., while pole 15 assumed 1,160 lb. of the total 4,000 lb. horizontal load, based on the assumption that the load carried by the two poles is proportional to the fourth power of their diameters at the ground line.

(E) Results were very satisfactory, the "X" braces transmitting the transverse load to a point lower on the poles and increasing the strength ratio 245 per cent over the unbraced structure A. The clamp on the "X" brace proved satisfactory, as it reduced the unsupported length and prevented the compression member from buckling, but still permitted movement of the braces so as properly to distribute the transverse load between poles.

Table I—Deflections and Stresses in Structures at Failure



	A	B	C	D	E	F	G
Dynamometer reading at failure (lb.)	5,400	7,200	8,400	4,000	9,500	9,600	9,700
Top deflection at failure	6 ft. 10 in.	6 ft. 0 in.	2 ft. 4 in.	7 ft. 8 in.	3 ft. 1 in.	5 ft. 3 in.	1 ft. 11 in.
Horizontal load from stress diagram (lb.)	3,925	5,370	6,550	4,000	9,480	9,500	9,660
Vertical load from stress diagram (lb.)	3,785	4,560	5,160	2,510	4,300	3,775	3,900
Fiber stress in pole first failing[1] (lb. per sq. in.)	4,550	5,530	*3,240	5,760	6,550	5,560	*3,230
Theoretical horiz. load developing 5,600 (lb. per sq. in.) fiber stress at ground line considering unbraced strs. as st. A	8,770	9,300	5,700	6,365	3,880	9,840	7,770
Ratio actual load to theoretical load	0.61	0.78	1.47	0.63	2.45	0.975	1.25
Relative values of structures based on structure A[2]	1.00	2.20	3.20	1.00	3.08	[3]	3.64

[1] These fiber stresses were calculated after making allowance for pole incision, where failure occurred at ground line.

[2] All structures are assumed to be of balanced symmetrical design, all materials to develop full shear, tensile and compressive stresses. It is also assumed that all joints, connections, etc., are rigid and that there are no secondary stresses produced by distortion.

[3] Structure F is indeterminate due to secondary forces and force couple at ground line resolving into uplift on pole opposite pole from pull.

* Poles did not fail.

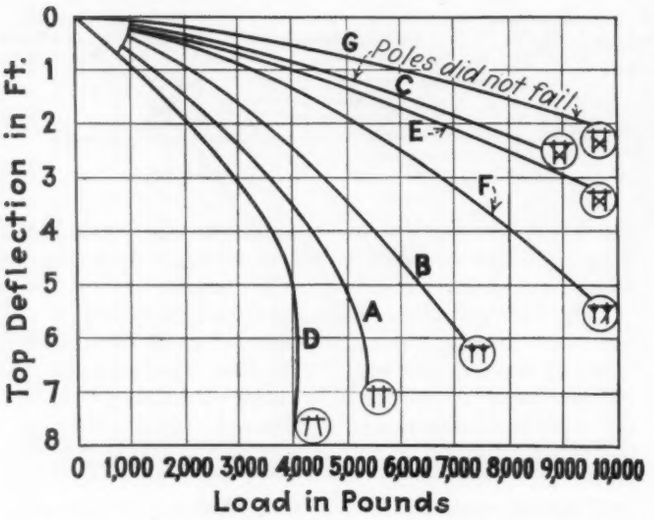


Fig. 3—Deflection of structures at different loadings

The loadings correspond to the dynamometer reading (Fig. 2) and had to be converted to horizontal and vertical components at conductor attachments by use of stress diagrams. No corrections are made for difference in pole strengths.

The first pole to break was 13, the fracture occurring 20 ft. above ground and just below the lower cross brace attachment. Pole 12 broke at the ground line.

(F) This structure is a duplicate of structure B, except that $\frac{5}{8}$-in. bolts were used in attaching the arm brace to the crossarm and a 10,000-lb. cross guy was used between poles. Results indicate 26 per cent improvement in strength over structure B and 58 per cent over structure A, partly due to increased strength in arm braces and partly to the cross guy. One disadvantage of this type of guy, aside from the lowering of impulse value, is that to strengthen the structure the guy must carry the entire transverse load with a short lead, as the poles will not take any transverse load without deflection, which the guy will not permit.

In this case, using two class 1 poles good for 9,000 lb. transverse load, the guy at 20 deg. lead angle must have an ultimate strength of 26,500 lb. If the lower guy attachment was raised to prevent excessive uplift on the back pole increased bending moment would result in the latter, causing failure.

Pole 10 failed at a point 13 ft. from the ground, due to the combination of column loading (producing crushing stress) and bending moment produced by horizontal load. Observation of this structure during and after failure indicated definitely a combined type failure, due neither to bending nor crushing stress separately. The guy, while preventing deflection, to a certain extent, causes a column loading effect, which, due to the exceptional high ratio of least dimensions to length (33 to 1), is undesirable in this type structure.

(G) This structure is a duplicate of structure D, except that class 2 and 3 poles were used and the upper brace attachment was placed 4 ft. below the crossarm instead of 2 ft. This heavy braced structure was tested in order to determine maximum possible transverse loadings with reasonable sized braces and attachments. Failure occurred by shearing of a $\frac{3}{4}$-in. bolt at the upper brace attachment on pole 7. Although this failure was disappointing, it clearly demonstrated the possibilities of increased transverse strength and minimum top deflections by using braces with fittings and attachments of adequate and well-balanced design.

Investigation of fiber stress revealed that the poles were stressed to only about half their ultimate strength. The highest stress was on pole 8 (which is opposite from that which failed first in structure E) and was due to the difference in ground line circumference or pole cross-section.

After completion of tests above, experiments were conducted on the brace fittings, altering the design to develop sufficient strength to shear $\frac{7}{8}$-in. bolts at approximately 32,000 lb., and later tested in subsequent full-size structures and found satisfactory.

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Post-Lightning Test Catches Fast Meters

By H. L. THOMPSON

Superintendent of Lighting Hartford Electric Light Company

Watt-hour meter maintenance and test methods have improved to the point where service meter accuracies warrant extended periods between routine tests, yet a few meters are still found off calibration. These occasional troublemakers must be eliminated or greatly reduced in number before periodic test schedules can be lengthened beyond four to six years.

Evidence points to the fact that lightning is the principal, if not the sole, cause of these failures. Systematic follow-up after lightning storms has demonstrated that the score can be greatly improved and the results obtained can be used as forceful argument for a lengthened periodic test schedule.

Examination of meters near lightning outages is a common practice. Test of such meters was, however, not undertaken in Hartford actively until the summer of 1932. In the first place it was not sufficient to rely on notice of service interruptions due to blown fuses or burned-out transformers. Sixty-cycle power-follow may affect the accuracy of meters or injure them without interrupting the service; also, blown secondary fuses may be replaced by the consumer without notifying the company. Therefore, the co-operation of the fire department, the telephone company and the local office of the Weather Bureau was solicited and secured. General employees were also asked to report lightning damage to houses, poles, trees, etc., and the newspapers were scrutinized for such reports.

A meter tester was then dispatched to these locations to test the service meter nearest to the scene of the reported stroke. If evidence of lightning effect on the meter was discovered meters in adjacent houses were

Test After Lightning Discloses Meters That Are Fast

	—Total Periodic Tests— (Year of 1932)				Tests After Lightning (Summer of 1932)			
	Light Load		Full Load		Light Load		Full Load	
Registration	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Over 104 per cent	53	0.30	31	0.18	13	5.78	14	6.22
101.5 to 104 per cent	703	4.03	458	2.53	47	20.90	34	15.10
98.5 to 101.5 per cent	12,954	74.34	15,361	88.18	148	65.75	171	76.02
96 to 98.5 per cent	3,624	20.75	1,577	9.05	11	4.90	1	0.44
Below 96 per cent	101	0.57	9	0.05	2	0.89	1	0.44
Stopped	2	0.01	1	0.01	4	1.78	4	1.78
Total Tests	17,437		17,437		225		225	

Final Manufacturers, Code Clauses

The final articles in the code for electrical manufacturers were omitted in the August 19 issue of ELECTRICAL WORLD because of an unfortunate error. These articles are very important, especially Article X, and are as follows:

X. If the supervisory agency determines that in any branch or subdivision of the electrical manufacturing industry it has been the generally recognized practice to sell a specified product on the basis of printed net price lists, or price lists with discount sheets, and fixed terms of payment which are distributed to the trade, each manufacturer of such product shall within ten days after notice of such determination file with the supervisory agency a net price list or a price list and discount sheet as the case may be individually prepared by him showing his current prices, or prices and discounts, and terms of payment, and the supervisory agency shall immediately send copies thereof to all known manufacturers of such specified product. Revised price lists with or without discount sheets may be filed from time to time thereafter with the supervisory agency by any manufacturer of such product, to become effective upon the date specified therein, but such revised price lists and discount sheets shall be filed with the supervisory agency ten days in advance of the effective date, unless the supervisory agency shall authorize a shorter period. Copies of revised price lists and discount sheets, with notice of the effective date specified, shall be immediately sent to all known manufacturers of such product, who thereupon may file, if they so desire, revisions of their price lists and/or discount sheets, which shall become effective upon the date when the revised price list or discount sheet first filed shall go into effect.

If the supervisory agency shall determine that in any branch or subdivision of the electrical manufacturing industry not now selling its products on the basis of price lists with or without discount sheets with fixed terms of payment the distribution or marketing conditions in said branch or subdivision are similar to or the same as the distribution or marketing conditions in a branch or subdivision of the industry where the use of price lists with or without discount sheets is well recognized, and that a system of selling on net price lists or price lists and discount sheets should be put into effect in such branch or subdivision, each manufacturer of the product or products of such branch or subdivision shall within twenty days after notice of such determination file with the supervisory agency net price lists or price lists and discount sheets as the supervisory agency may direct containing fixed terms of payment showing his prices and discounts and terms of payment, and such price lists and/or discount sheets and terms of payment may be revised in the manner hereinabove provided.

No employer shall sell directly or indirectly by any means whatsoever any product of the industry covered by the provisions of this article at a price lower or at discounts greater or on more favorable terms of payment than those provided in his current net price lists or price lists and count sheets.

XI. Aggregations of employers having a common interest and common problems will be grouped by National Electrical Manufacturers Association for administrative purposes in various subdivisions or product classifications and report of such grouping made to the administrator.

XII. In each subdivision or product classification there will be a supervisory agency approved or appointed by the board of governors or the executive committee of National Electrical Manufacturers Association and report thereof made to the administrator. If normal complaint is made to National Electrical Manufacturers Association that the provisions of this code have been violated by any employer, the proper supervisory agency shall investigate the facts and to that end may cause such examination or audit to be made as may be deemed necessary.

XIII. The President may, from time to time, cancel or modify any order, approval, license, rule, or regulation issued under Title I of the National Industrial Recovery Act.

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tested. An inspection of the neutral ground was also made and a sketch of the service and nearest lightning arrester layout incorporated with the tester's report.

During the summer of 1932 the locations of 101 reported lightning strokes were visited and 225 meters tested. Sixty-eight meters (30 per cent of the total) were more than 1½ per cent fast or else defective. Fourteen meters were over the legal limit of 4 per cent. Twelve were removed for overhauling. The results have fixed the determination to continue and further perfect the practice.

The bearing of these data upon the periodic test period can be sensed by comparing them with the corresponding figures for periodic tests. For the year 1932, 31 meters, or 18/100 of 1 per cent, were found over 4 per cent fast, as compared with fourteen meters found fast in the special post-lightning test. Presumably if special lightning tests had been made each year over the four-year test period they would have prevented the continuance of a large proportion of the fast errors otherwise discovered only on the periodic tests reported to the Public Utilities Commission.

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Much Undeveloped Canadian Hydro

Five-sixths of Canada's known available water power still awaits development, the Dominion Water Power and Hydrometric Bureau reports. Unlike the condition in the United States, much of this is in the eastern part of the country, not excessively remote from the industrial area.

Analysis of existing plants shows the average machine installation to be 30 per cent greater than the ordinary six-month flow power. Using this ratio, it is computed that the present recorded sources, with an aggregate of 33,600,000 hp., will permit of a turbine installation of about 43,700,000 hp., whereas only about 7,000,000 hp. has been installed. No account is here taken of possible unrecorded rapids and falls still to be studied, especially in the less explored northern regions. Additions during 1932 amount to 379,000 hp., or 5.7 per cent, and during the past two years to 920,000 hp., or 15 per cent.

Of the present total, central stations have 6,111,641 hp., pulp and paper mills 600,996 hp. and other industries 332,623 hp. Of the last named more than 110,000 hp. is in the mineral industries.

Potential and Developed Water Power in Canada

Province	Available 24-Hour Power at 80 Per Cent Efficiency: At Ordinary Minimum Flow, Hp.	At Ordinary Six Months Flow, Hp.	Turbine Installation: 1930 Hp.	1931 Hp.	1932 Hp.
Prince Edward Island	3,000	5,300	2,439	2,439	2,439
Nova Scotia	20,800	128,300	114,224	111,999	112,167
New Brunswick	68,600	169,100	113,681	133,681	133,681
Quebec	8,459,000	13,064,000	2,718,130	3,100,330	3,357,320
Ontario	5,330,000	6,940,000	2,088,055	2,145,205	2,208,105
Manitoba	3,309,000	5,344,500	311,925	390,925	390,925
Saskatchewan	542,000	1,082,000	42,035	42,035	42,035
Alberta	390,000	1,049,500	70,532	70,532	71,597
British Columbia	1,931,000	5,103,500	630,792	655,992	713,792
Yukon & N. W. Terr.	294,000	731,000	13,199	13,199	13,199
Canada	20,347,400	33,617,200	6,125,012	6,666,337	7,045,260

Radio Power from High-Voltage Rectifiers

By N. KOTSCHUBEY
Brown, Boveri & Company, Ltd., Zurich, Switzerland

INTENSIVE development of wireless transmission and, above all, the big outputs for which individual transmitting valves can now be made have brought about a corresponding transformation of the converter plants to supply d.c. to these stations. The general trend of the development of such equipments was in the course of recent years to increase the output of the transmitting valves without being obliged to use a large number of valves in parallel. Transmitting valves are now built for d.c. voltages up to 25,000. Experience gained recently in numerous plants working with mercury-arc rectifiers proves that for outputs as low as 60 kw. and upward and at voltages over 10,000 this type of converter is the most economical and the most reliable.

The first rectifier for 400 kw. output at a service voltage of 12,000 was put into service in the year 1929 by the Marconi Wireless & Telegraph Company, Chelmsford. Metal-clad mercury-arc rectifiers have since been generally adopted for most of the new broadcasting stations. The Marconi Wireless Company, which equipped the broadcasting stations of Warsaw, Poland, Beromünster (Switzerland), Athlone (Irish Free State) and Monte Ceneri (Switzerland) adopted in these plants throughout metal-clad mercury-arc rectifiers, the output of which varies between 60 and 500 kw. The Warsaw station has two 500-kw. mercury-arc rectifiers operating at 15,000 volts d.c. The Athlone broadcasting station of the Irish Free State has two 230-kw., 13,000-volt rectifiers. The Hungarian subsidiary company of the Standard Telephone & Telegraph Company also decided to use in the new Hungarian broadcasting station in the neighborhood of Budapest a 500-kw., 22,000-volt metal-clad Brown Boveri mercury-arc rectifier unit. An 800-kw., 18,000-volt mercury-arc rectifier has just been put into operation in a Mexican station. In eleven new broadcasting stations installed by the German postal authorities metal-clad mercury-arc rectifiers replaced the formerly adopted motor-generator sets, as well as the thermionic hot-cathode rectifiers. All of these rectifiers operate under normal conditions at 6,000-13,000 volts. One rectifier installed at Zeesen has been submitted to protracted tests for more than a year under d.c. pressure up to 20,000 volts and the results reached at such high d.c. voltages were astonishing and showed that the further development of this special type of metal-clad rectifier was most promising.

Design modified for high voltage

Several important alterations had to be adopted for rectifiers used for voltages over 5,000, especially the anodes and auxiliaries. The general layout of a high-tension rectifier plant is somewhat similar to that usually adopted for mercury-arc rectifier units used in railway service. Each rectifier has six main anodes, two excitation anodes and an automatic ignition device. The cathode under the tank is usually electrically connected to the anodes of the transmitting valves. The negative rectifier pole is formed by the neutral point of the main transformer and it is connected to the cathode of the transmitting valve. It remains thus earthed as well.

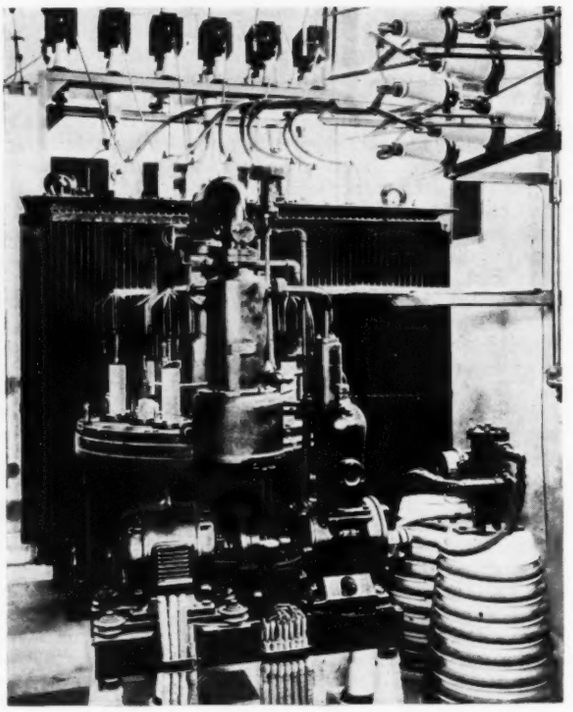


Fig. 1—Swiss broadcasting station's (Beromünster) 270-kw., 13,000-volt metal-clad mercury rectifier with grid control

The main transformer is built as an ordinary rectifier transformer and is distinguished by very heavy insulation of the secondary winding. On the primary side the set is protected by a three-pole alternating-current circuit breaker equipped with overcurrent relays. No circuit breaker is required on the d.c. side.

Three schemes for voltage regulation

For the voltage regulation in high-tension mercury-arc rectifier plants three different arrangements can be adopted. These are induction regulators, regulating transformers with step switches, and grid control. Induction regulators allow of obtaining a very satisfactory regulation curve, but lower the over-all efficiency of the plant as well as the power factor. Regulating transformers for step switches can be used with from 20 to 60 steps, according to the system of connections. Regulation of the voltage thus obtained is not gradual, but is in jerks from step to step. For various transmission service this drawback can be disregarded as adjustment of the voltage during service is seldom required.

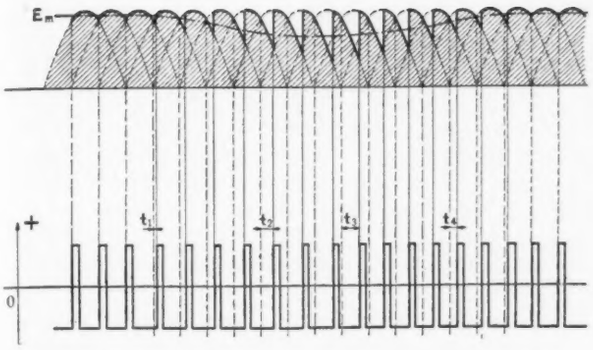


Fig. 2—Grid control by synchronous contact-maker
Time lag of ignition varied to regulate duration of arc current and therefore of mean electrode voltage.

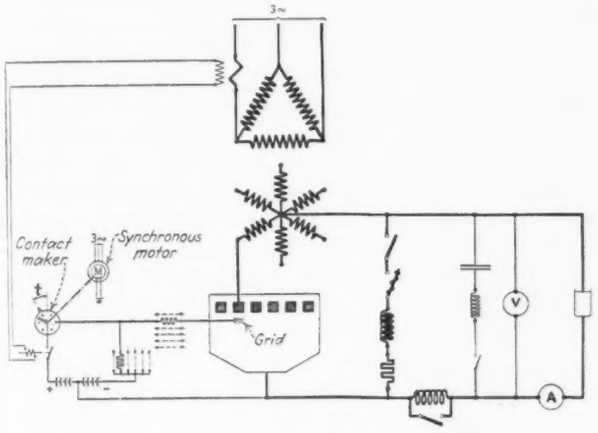


Fig. 3—Filter aids transformer reactance in smoothing voltage wave

It seems that the voltage regulation by grid control as used in high-voltage rectifier plants presents advantages which are common to both the above-mentioned methods of voltage regulation and at the same time avoids the disadvantage of lowering the over-all efficiency and the power factor of the plant. Grid control voltage regulation consists in the displacement of the point of ignition of the rectifier arc; that is, it is possible to control the moment at which the arc strikes during the positive half wave. For that purpose the negative potential is continuously applied to the grids from an auxiliary low-voltage d.c. source through a special contact maker. By the displacement of the contact maker it is possible to obtain the desired point at which the arc strikes. It is therefore possible to arrange that the arc always strikes with a constant time lag relative to the point on the positive half wave at which the arc would strike if the grid were not charged at all. The middle part of Fig. 2 shows the result of delaying the striking point.

Operation of the grid control voltage regulation is usually remote and actuated directly from the operator's desk in the transmitting room. By operating this remote control switch it is possible to raise or to lower the d.c. voltage at will. The readings of the obtained voltage are made on a voltmeter mounted in a special insulated switchboard.

A successful innovation was recently made in connection with the adoption of grid control voltage regulation of high-tension rectifiers. This innovation consists in a very efficient protection of the high-voltage rectifier against short circuits inside or outside the apparatus. This is not only a protection of the rectifier but of the transmission station itself. The device in question consists in another utilization of the control grids mentioned above. The grids are connected up continuously with the positive pole of a small three-phase direct-current converter through suitable bushings and limiting resistances. The imposition of a positive potential raises the current-passing qualities of the anodes so that the latter are able to take very low loads (down to a few milliamperes) without trouble.

Apart from these grids each rectifier is equipped with a grid relay which is characterized by the quality of extraordinarily rapid action. The grid relays are connected to the secondary side of a current transformer, which in turn is inserted in one phase of the incoming three-phase supply. As soon as a short-circuit on the d.c. side causes the grid relay to act the current system feeding the grids is switched over to the negative pole or in case of a simultaneous use of the grid control voltage regulation only negative potential is given on the grids. This prevents the ignition of all the anodes which are not burning. The anodes which happen to be burning are extinguished in a space of time which is less than $\frac{1}{2}$ cycle. Further, the system of protection has the valuable property of taking into account satisfactorily the special conditions inherent to transmitting valves, and whatever the service conditions happen to be the rectifier will be cut out perfectly and in the shortest possible time. Thus it is possible to prevent the transmitting valves being damaged by heavy short-circuit currents, this because the rectifier is cut out in a very short space of time and the cathode of the valve has not time to get too hot.

A further arrangement allows of bringing down the service voltage to its lowest value automatically after the rectifier has been cut out; thus starting up again takes place under the lowest possible voltage, having regard for the special conditions of transmission valve operation. The device can be designed so that after service has been taken up again the pressure comes up automatically to the value desired in a very short time.

The high-voltage metal-clad rectifier is in all respects the best converter on the market and can be adopted unreservedly for various transmitting stations owing to its service reliability, high efficiency and general insensibility to short circuits, excellent pressure-regulating facilities, contact design and, above all, unlimited length of life.

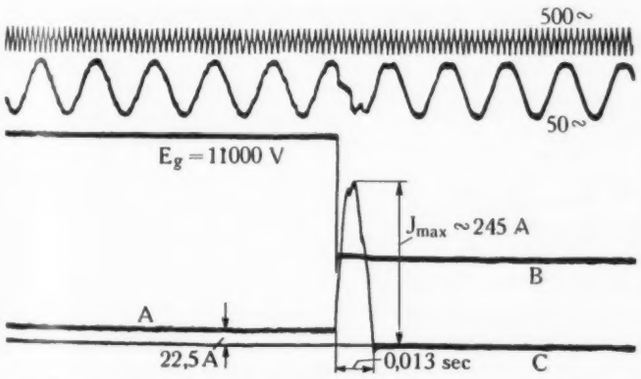


Fig. 4—Grid control clears 1,000 per cent short in 0.013 second

Central Station June Revenue More Than May

Contrary to the usual course at this time of year the revenue of electric light and power companies in June materially exceeded that of May. A rise of more than $3,500,000 brought the estimated total for the entire industry in the United States to $153,590,000, and so within less than 1 per cent of last year's total for the same month.

This progressively closer approach, month by month, to the corresponding income in the preceding year registers the effect of expanding industrial energy consumption. As recently as last March there was a disparity of 9.7 per cent. This shrank to 7.5 in April and 5.3 per cent in May, with the strong probability that July will be the first month since the autumn of 1930 to show an excess for the yearly interval. Operating and maintenance expenses, $64,870,000, though greater than in May, remained 2 per cent smaller than they were a year ago.

The item in which greatest growth was reported is the energy output, 6,768,000,000 kw.-hr., 10 per cent larger than last year and 3 per cent more than in May—unusual because there is normally a decrease. Energy from fuel was 18 per cent more than in May and 8.5 per cent more than in June of 1932. This is the first time since July, 1931, that the year's change has been an increase.

Production from water power fell off 12 per cent from May, in consequence of the usual diminution of stream flow, but maintained a lead of 12 per cent over last year. It constituted 42 per cent of the total output.

Output was larger than a year ago in every one of the nine geographical regions except the Pacific, and surpassed May in all except the South Atlantic.

For many months revenue has not only been diminishing in the country as a whole, but each individual section has shown a decline when corresponding months were compared in consecutive years. The disparities were not large, in the light of the shrinkages suffered by some other industries, but they stood out in contrast with former almost uninterrupted growth.

This line of downward movements has at last been broken. The figures reflect the demands of general industry in the East, textiles in the South, automobile and steel production in the Central area.

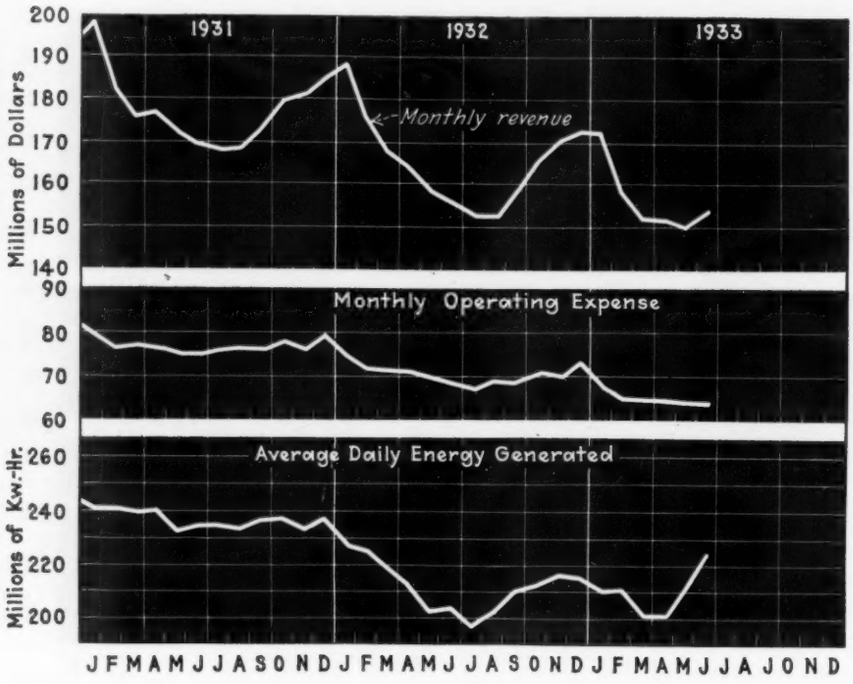


Table I—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1933	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
March	6,264,683	— 8.2	2,879,329	— 1.2	3,385,354	—13.3	1,604,000	— 6.0
April	6,058,661	— 4.5	2,945,376	— 0.2	3,113,285	— 8.5	1,596,000	+ 1.3
May	6,573,647	+ 5.4	3,220,470	+13.9	3,353,177	— 0.8	1,709,000	+ 2.4
June	6,768,162	+10.0	2,820,138	+12.2	3,948,024	+ 8.5	1,739,000	+ 7.5

Table II—Regional Revenue, Energy Output, in June, 1933

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	153,590	— 0.9	6,768,162	+10.0	2,820,138	+12.2	3,948,024	+ 8.5
New England	16,020	+ 2.7	469,412	+21.0	187,003	+ 7.1	282,409	+32.4
Middle Atlantic	39,620	— 0.5	1,673,596	+ 7.5	524,317	+19.3	1,149,279	+ 3.0
East North Central	35,650	— 1.3	1,558,055	+11.7	178,511	+13.6	1,379,544	+11.5
West North Central	12,610	— 3.1	461,957	+ 5.8	150,816	+ 6.2	311,141	+ 5.3
South Atlantic	18,110	+ 2.9	818,657	+24.0	512,132	+39.0	306,525	+ 5.3
East South Central	5,270	— 0.5	319,546	+16.0	277,633	+19.0	41,913	+ 0.2
West South Central	8,140	— 3.3	368,773	+ 3.3	27,591	+361.0	341,182	— 2.7
Mountain	3,515	— 1.8	202,024	+12.8	165,113	+17.1	36,911	— 6.0
Pacific	14,655	— 3.9	896,142	— 0.7	797,022	— 5.5	99,120	+73.0

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

Table III—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

Month	Total Gross Revenue from Sale of Energy*		Total Operating and Maintenance Expense†	
	1933 Thousands	Per Cent Inc.	1933 Thousands	Per Cent Inc.
Mar.	$151,920	— 9.7	$64,550	— 8.7
April	151,420	— 7.5	63,380	— 6.2
May	149,950	— 5.3	63,420	— 4.5
June	153,590	— 0.9	64,870	— 2.0

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.

†Does not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions.

"No-Growth" Load Curve Aids Analysis of System Progress

By GEORGE E. QUINAN*

Chief Engineer Puget Sound Power & Light Company

As a business barometer and an index of revenue, energy output figures are being scrutinized closely. A static reference point for measuring growth is necessary for their interpretation.

DURING the past few years the records of energy outputs of the central stations of the country have assumed nation-wide interest as barometers of business. They are computed and published weekly for the country as a whole, and any apparent increase is held as a precursor of business revival. Central-station engineers and accountants also are showing a keen interest in output trends because of the bearing on revenue. Monthly increases or decreases are usually determined either with reference to the corresponding month of the previous year or the total energy output for the year ending with the current month is compared with the corresponding figure for the previous month.

Because of seasonal variations in the electricity-using habits of central-station customers the conclusions reached frequently are erroneous. For example, if July of this year is greater than July of last year, it is clear that growth has occurred during the year, but this growth may have ended six months previously and a decline may have been in progress since. The same thing is true for the comparison which uses the year ending with current month. The pertinent question today is: Are we doing better than we were last month, three months ago, six months ago? The record of system output does not give the answer.

As an illustration, the monthly energy output of the Puget Sound Power & Light Company reached its highest point of record in November, 1930. Each month in 1930 was higher than the corresponding month of 1929 up to November. In December the decline appeared to commence, but actually it started in August and had been in progress for four months.

Seasonal changes follow the sun and constitute a cycle one year in length before repeating. The character of the cycle and the magnitude of its variations depend on the types of load carried by the system. An exclusively lighting load when plotted would approximate a sine curve. A load largely independent of light and weather, such as mining, smelting, chemical industries, etc., would be fairly free of seasonal variations. In the great majority of cases, however, the monthly energy output of a central station shows marked variations from month to month, and these are repeated from year to year.

No-growth curve resembles sinusoid

The load curve, either positive or negative, is superimposed on this basic cycle and obscures it, the total load consisting of the sum of the two. Different rates of growth change the whole appearance of the energy output curve. Stripped of its growth—that is, the no-growth load curve—the purely seasonal curve changes only when the character of the load changes.

For accurate interpretation of energy output figures it becomes necessary to determine the appearance of the cyclical no-growth curve. This curve is buried in every load curve and can be found nowhere else. If it were possible to create a static condition for one year with no load added or lost and no increase or decrease in the customary hours' use by our customers, the result would be a succession of monthly energy outputs that, when plotted, would constitute a no-growth load curve. This curve at the end of a year would begin to repeat. Every January would be the same as every other January, and so far all the other months. It would reveal the seasonal habits of the customers and the inherent annual load factor of the system. Such a curve would be an absolute reference system for determining growth, whether positive or negative.

As stated before, the no-growth curve is buried in the actual load curve of the system. To disclose its contours it is necessary to remove the overburden of growth. Now if it is possible to find a year in which there has been a uniform rate of growth and to determine a law of growth in terms of the monthly ordinates of the underlying no-growth curve, the problem is capable of solution.

An examination of the monthly energy outputs for a period of several years will usually be sufficient to discover a year which experienced uniform growth. In the case of the Puget Sound Power & Light Company the years 1925, 1926, 1927 and 1928 were examined. Growths in the energy outputs were 11½ per cent, 12 per cent and 11 per cent, respectively. In addition there was close consistency in the monthly outputs in the several years, with the exception of the fall of 1926, which could not be reconciled with the other years. A year of presumably uniform growth was finally deduced from the years 1925, 1927 and 1928.

Normal rate of growth to be determined

In getting at the law of growth as a function of the unknown ordinates of the no-growth curve, it was reasoned that the approximately unchanging characteristic shape of the annual load curve implied a growth from month to month as a percentage function of the no-

**Abstract of a paper presented at the Engineering Section, Northwestern Electric Light and Power Association, Portland, Ore.*

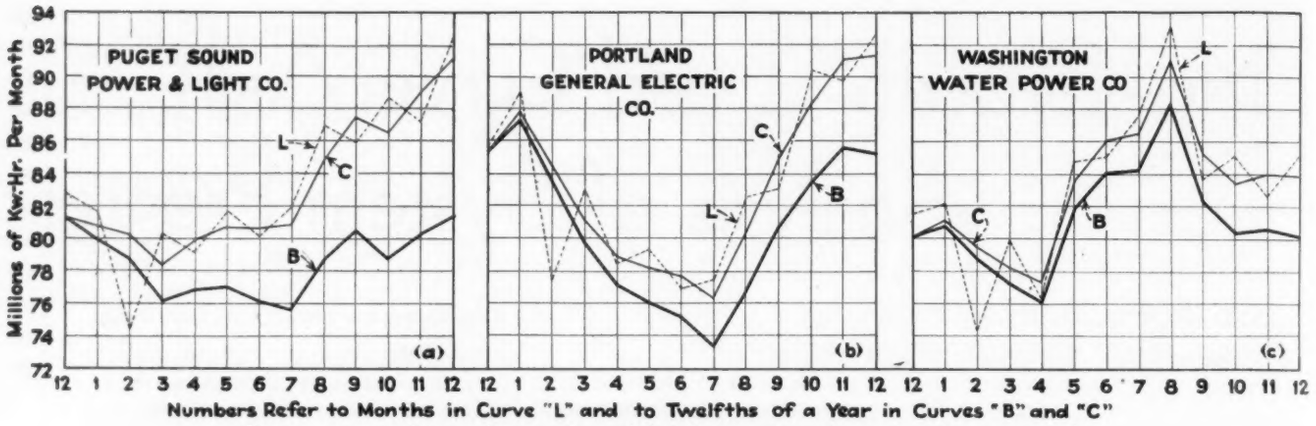


Fig. 1 a, b, c—Normal growth, weighted growth and no-growth contrasted

L = Monthly energy curve whose last twelve ordinates total 1,000,000,000 kw.-hr. The ratio of the value of the respective monthly ordinates to the sum of the ordinates is the mean of the corresponding ratios for two or three of the three actual load years 1925, 1927, 1928.

C = Monthly energy with growth and the assumption that each month is just one-twelfth of a year in duration and every day a weekday. The total value last twelve ordinates is 1,000,000,000 kw.-hr.

B = Same as the C curve but with the growth removed. The total values of the last twelve ordinates are as follows: Puget Sound Power & Light Company, 939,593,000; Portland General Electric Company, 963,780,000; Washington Water Power Company, 975,855,000 kw.-hr.

growth ordinates, the percentage remaining constant so long as the rate of growth did not change. That is to say, each month must contribute to the growth in proportion to its own size. If this were not true, then any month, say July, which regularly contributed a greater percentage of itself than did December would, in a very few years, become greater than December. We know from experience that this does not happen.

Based on this reasoning we have a simple method for obtaining the no-growth curve:

Let $B_1, B_2 \ldots B_{12}$ = the no-growth energy in kilowatt-hours for each twelfth of the year.

Note— If data were carried beyond the thirteen-month period it would be found that $B_1 = B_{13}$ and $B_2 = B_{14}$, etc.

Let $C_1, C_2 \ldots C_{12}$ = the total energy generated for each twelfth of the year.

Let C_0 = The energy in kilowatt-hours generated in the last twelfth of the preceding year.

Let P = rate of growth in one-twelfth of a year.

$$C_1 = B_1 (1 + P)$$
$$C_2 = B_2 (1 + P)^2$$
$$C_3 = B_3 (1 + P)^3$$
$$\ast \quad \ast \quad \ast$$
$$C_{11} = B_{11} (1 + P)^{11}$$
$$C_{12} = B_{12} (1 + P)^{12}$$

$$\text{Therefore } (1 + P)^{12} = \frac{C_{12}}{B_{12}} = \frac{C_{12}}{C_0}$$

$$(P) \text{ from } \operatorname{Log} (1 + P) = \frac{\operatorname{Log} C_{12} - \operatorname{Log} C_0}{12}$$

$$\text{and} \quad Q = \frac{1}{1 + P}$$

$$\text{Then} \quad B_0 = C_0 = B_{12}$$
$$B_1 = C_1 Q$$
$$B_2 = C_2 Q^2$$
$$\ast \quad \ast \quad \ast$$
$$B_{11} = C_{11} Q^{11}$$
$$B_{12} = C_{12} Q^{12} = C_0 = B_0$$

Basing our calculations on the years selected above, it was possible to reconstruct the no-growth curve B shown on Fig. 1a. Since this curve is discontinuous from month to month no general equation can be written for it, but it can be expressed with complete generality by setting down the ratios of the respective ordinates to the sum of all the ordinates. The curve here obtained is plotted not by months, but by the twelfths of the year, and the year is assumed to consist of nothing but weekdays. It reflects in effect the activity of the electric market in terms of kilowatt-hours per twelfth of a year, or kilowatt-hours per day for the entire year. The particular kilowatt-hour values applying to the ordinates of the curve here shown are of no importance. The ratios of the respective ordinates to the sum of all the ordinates are the significant things and the curve can be plotted for any kilowatt-hour values that may be desired.

Monthly energy outputs of the Puget Sound Power & Light Company for 1932 and part of 1933 with a no-growth load curve based on August, 1932, are shown in Fig. 2. The latter curve was completely determined when it was assumed that its August ordinate equaled the August ordinate of the actual load curve. It shows what the monthly energy outputs would have been subsequent to August had there been no gain or loss. It also shows how rapidly prior to August the load dropped off toward the bottom reached in that month.

Sundays converted to weekday equivalent

The actual procedure for obtaining the no-growth load curve by months in the instance just cited is as follows: August, 1932, is first reduced to equivalent weekdays by adding to the 27 actual weekdays 72 per cent of the four Sundays, giving 29.88 equivalent weekdays (the outputs on Sundays and holidays in the Puget Sound territory are about 72 per cent of average weekday outputs). The output per average weekday for August, 1932, is obtained by dividing the actual output by 29.88 equivalent days. This output per equivalent weekday is then assigned as the kilowatt-hour value of the August ordinate of a no-growth curve and the latter is developed for all twelfths of the year by using the ratios previously obtained and referred to above. This curve is not shown in Fig. 1a, but is a working curve similar to the no-growth curve developed in Fig. 1a and is plotted by twelfths of the year on the assumption that all days are weekdays. It might very well be called an active curve and be plotted to show kilowatt-hours per weekday. The actual no-growth outputs by months for the remaining

Figures are based on August, 1932, as a reference. Curve L is the actual energy generated and purchased per month. Curve B is the energy that would have been generated and purchased on a no-growth basis with static conditions as of August, 1932.

	Total Megawatt-Hours
Curve L, 1932	824,481
Curve B_1, 1932	801,304
Curve B_1, 1933	798,333

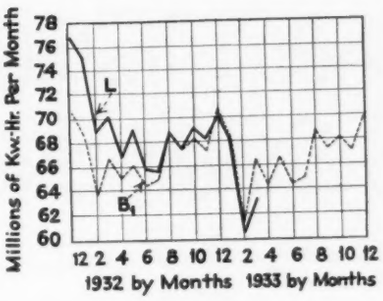
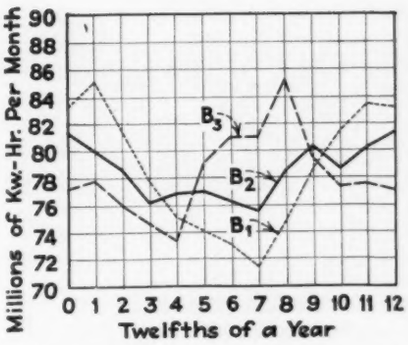


Fig. 2—True decline shown by comparison of actual and no-growth curves

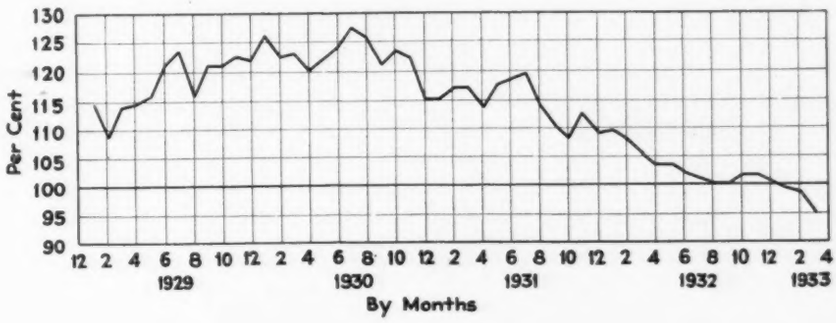


Curve B_1 is the seasonal energy of the Puget Sound Power & Light Company with the growth removed and the assumption that each month is just one-twelfth of a year in duration and every day is a weekday. Curves B_2 and B_3 are for the Portland General Electric Company and Washington Water Power Company respectively. The annual energy under each of the three curves is the same.

Fig. 4—No-growth load curves show phase displacement

Fig. 3—Energy outputs by months as percentages of the outputs which would have occurred under static conditions based on August, 1932

This no-growth curve shows the highest point was reached in July, 1930, although actual system outputs continue to be higher than the corresponding months of 1929 up to and including November.



months of 1932 are then obtained by reducing each month to its equivalent weekdays and multiplying the number of equivalent weekdays by the kilowatt-hours per weekday shown by the no-growth activity curve.

The amounts by which the actual loads were above or below the August, 1932, level are plotted in Fig. 3, as percentages of the respective ordinates of the no-growth load curve for the years 1929 to 1932, inclusive. The curve of this figure is entirely free of seasonal influence. Variations in its ordinates are due solely to gain or loss. It shows that the highest point reached was in July, 1930, although the actual outputs continued to be higher than the corresponding months of 1929 up to and including November.

No-growth curves have striking characteristics

No-growth load curves are shown in Figs. 1b and 1c for the systems of the Portland General Electric Company and the Washington Water Power Company. These are based on the outputs of 1927 and 1928 without detailed analysis of other years. While not as carefully prepared as the curves for Puget Sound Power & Light Company they are probably very closely approximate.

In Fig. 4 are shown the characteristic no-growth curves for the three systems of Portland General Electric Company, the Washington Water Power Company and Puget Sound Power & Light Company, plotted for the same total annual outputs. They therefore reflect in the same scale the inherent characteristics of the loads of the three systems. It will be noted that they are strikingly different.

No-growth load curves serve another important purpose aside from their value in accurately checking the gain or loss in system output. As previously stated, the no-growth curve shows the fundamental system characteristics, which in turn are dependent upon the basic loads and customer habits. Over a period of time such a curve, by changes in its original shape, will show the effect of load-building efforts in their relation to system load factor and system peaks. It should prove a valuable method of measuring results heretofore impracticable of evaluation.

Ratios in Per Cent of Each Monthly Ordinate to the Total of Twelve Ordinates

	Puget Sound P. & L. Co.			Portland General Electric Co.			Washington Water Power Co.		
	L	C	B	L	C	B	L	C	B
January	8.165	8.068	8.506	8.907	8.781	9.060	8.217	8.117	8.286
February	7.430	8.017	8.373	7.728	8.437	8.656	7.422	7.951	8.087
March	8.026	7.831	8.101	8.302	8.107	8.272	7.996	7.818	7.922
April	7.905	7.980	8.179	7.842	7.880	7.994	7.626	7.728	7.802
May	8.165	8.069	8.192	7.930	7.820	7.889	8.480	8.354	8.403
June	8.012	8.063	8.108	7.690	7.768	7.792	8.515	8.609	8.627
July	8.176	8.078	8.047	7.741	7.630	7.611	8.760	8.652	8.638
August	8.689	8.479	8.367	8.260	8.019	7.954	9.316	9.107	9.059
September	8.588	8.754	8.558	8.311	8.482	8.366	8.370	8.528	8.452
October	8.868	8.653	8.379	9.044	8.828	8.659	8.517	8.349	8.243
November	8.724	8.895	8.532	8.978	9.113	8.888	8.267	8.401	8.263
December	9.252	9.113	8.658	9.267	9.135	8.859	8.514	8.386	8.218
Total	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

Underground Conduit Installed With No Street Excavation

By SHERMAN J. KLINE

Tulsa, Okla.

Laterals for fire alarm system in Tulsa pushed through the ground.
Hydraulic pipe pusher used.
Details of installation.
Saved more than $9,000.

THE city of Tulsa recently prepared plans and specifications for the installation of a complete new fire alarm system, divided into four major parts: Fire alarm building; duct system; cables, and fire alarm instruments consisting of cross-connecting racks, panels, registers, batteries, generators, pedestals and fire alarm boxes. The Dodge Electric Company was successful in securing the contract for installation of the duct system, which included thousands of feet of two-, four- and six-compartment clay duct, to be intersected with manholes at each street intersection.

Included in the system were additional thousands of feet of galvanized iron conduit, ranging from ½ in. to 3 in., to be used for laterals running from the various manholes to the hundreds of locations such as fire alarm pedestals, pole terminals, fire alarm stations located all over the city, to the residences of the superintendent and assistant superintendent of fire alarm and to homes of the fire alarm operators. This program of lateral conduit to be installed presented a difficult problem, since 90 per cent of the conduit was to be placed 24 in. under the existing pavement.

Expected to cut pavements

Engineers who prepared the plans and specifications did not prescribe the manner of installation, as it was naturally supposed and understood that the only way this could be executed would be to use air compressors with paving cutters and to cut the pavements from end to end where conduits were to be laid. According to requirements of the city's street department, this would entail the removal and replacement of a strip of pavement 24 in. wide, it being demanded that in making the excavation an 8-in. shoulder of earth must be left intact on each side between the pavement and the ditch, to provide a solid footing rather than a fill to support the new paving when replaced, leaving a width of only 8 in. for the ditch, to be dug 24 in. deep.

Before an estimate of the job could be made weeks were required to inspect proposed routes of the duct and lateral systems, during which time C. H. Veale, superintendent of the electrical division of Dodge Electric Company, had in mind the idea that if he could improvise a sufficiently powerful hydraulic press to push the conduit under the pavement for blocks at the required depth an enormous saving could be effected, since the cost of cutting pavement, excavating, back-filling, tamping and repaving would amount to $1 per lineal foot, the total running into thousands of dollars. However, he was unable to locate any such equipment which was fast enough to do the work economically. Therefore the estimate was prepared to include cost of cutting and replacing the pavement, bids were submitted and Mr. Veale's firm secured the contract, which specified that the job must be completed in 90 working days, and carloads of tile and conduit were ordered for the work.

Chanced upon a pusher

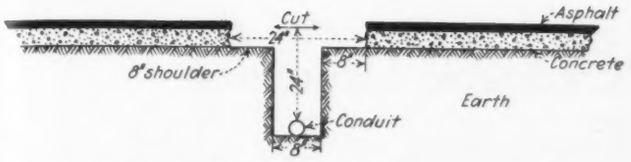
Before this material arrived a circular was received by mail describing a hydraulic pipe pusher recently placed on the market by the Greenlee Company and claiming that with the aid of this device one man could push pipe under a concrete slab by operating two levers in a forward and backward motion which would impose 40,000 lb. pressure.

This immediately completed Mr. Veale's thought, it being easy to determine that, with the machine costing $290, the expense incidental to taking up and replacing only 290 ft. of paving would pay for the equipment. So he decided to gamble the price of one machine for experimental purposes and ordered it shipped by express.

Upon arrival of the machine tests were made, and although it was found that the pipe would not push straight on a long, hard push, a week of experimenting revealed the fact that this could be done by stiffening the end of the conduit that was pushed ahead, this being accomplished by means of a solid piece of steel shafting just the size of the interior of the conduit and running back 24 in. into the latter.

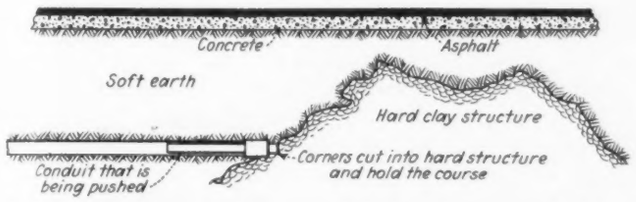
Further tests showed that in order for the conduit to hold a straight course while being pushed it was necessary to make the nose of the steel shaft (or stiff arm) blunt with sharp edges like a lathe tool, due to the fact that a round or pointed nose proved to be a failure since it would permit the conduit to ride up and over hard strata encountered, instead of penetrating them. With the blunt-nosed stiff arm the pipe held a true course and could be pushed a block at a time. In other words, the corners of the stiff arm cut and hold the course and the coupling reams the hole, reducing the friction of the pipe to a minimum, whereas were it not for the blunt nose or sharp corners on the stiff arm the conduit would naturally rise and follow the lines of the hard structures met en route to the next manhole. This was one of the difficulties in connection with the job which required a great deal of experiment to overcome.

The hydraulic pump or pusher—which could be termed a "jack"—consisted of two cylinders of high and low pressure built of heavy malleable iron and operated by two levers made of 1-in. steel tubing, each 4½ ft. long.

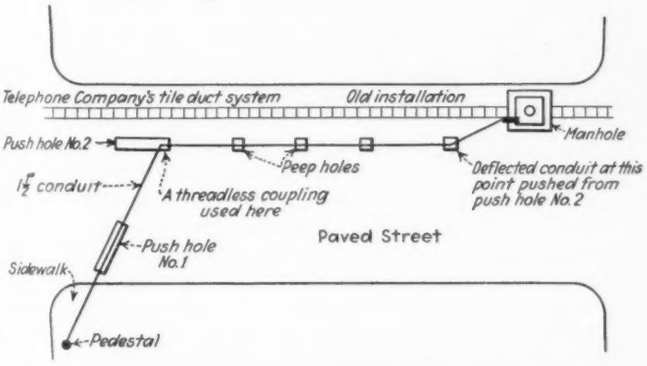


Typical requirements for pavement cutting for installing lateral conduits

Conduit was stiffened for pushing by use of steel shaft in the end



For straight courses the nose of the shaft was made blunt and the coupling acted as a reamer



Arrangement for pushing conduit permitted some 15 to 20 deg. bends

An 8-in. treated plank was placed over the tile duct before filling

Conduit was pushed around this bend

Pushing machine in trench and peep-holes for observing conduit

This hydraulic pusher or "jack" operates on 8 ft. of standard railroad iron rail, traveling from one end of the rail to the other as the levers are operated and pushing the conduit ahead 8 ft. before it becomes necessary to reset the machine.

Mr. Veale learned by experience that in an installation of this kind it was essential to lay the conduit deeper than specified due to water and gas taps (located on an average of every 25 ft., being found at a depth of about 24 in., which necessitated lowering his pushing level to 30 and 36 in. On long pushes in blocks measuring from 400 to 600 ft. in length he opened the pavement in the center of the block to make room for the machine and pushed the conduit both ways from that point, making a cut in the pavement 24 in. wide and 13 ft. long and excavating to a depth of 40 in. By setting up the machine on the bottom of the push hole, the rail and machine being approximately 10 in. high, the pipe was permitted to enter the bank 30 in. below grade.

Experience in pushing the pipe horizontally underground also disclosed the fact that the only way the pipe could be deflected from its course was by striking large obstructions, such as huge rocks or broken concrete which had been used for fills, since stones up to the size of a man's hat could be pushed ahead of the pipe and offered no interference with its progress.

Consequently, Mr. Veale deemed it advisable to cut a "peephole" every 30 ft. in line with the pipe's course, this excavation being 24 in. square and dug to the depth of the pipe. In event of a slight deflection it was by this method easy to redirect the course of the conduit as it approached the peephole and to remove the large stones, chunks of concrete, etc., which were often pushed ahead of the pipe. As a result this first week of experimenting the plan was considered a success

and an order was placed for two additional pushing machines.

Before the job was completed the machine operators had become experts, being easily able to push a line of conduit diagonally across the street for 100 ft. and meet an opening 30 in. below the surface which had been drilled through the concrete wall of a manhole. This was repeatedly done day after day as all conduits terminated in the manholes. Moreover, they also actually accomplished the likewise seemingly impossible feat of pushing conduit virtually around the corner, deflecting it from 15 to 20 deg. and successfully pushing it through an opening cut in the wall of the manhole.

Because the engineers would not permit the use of regular 90-deg. factory conduit ells in turning up the pipe from a 30-in. level to the pedestal locations, stating that it was too abrupt a radius to subject the cables to on a long pull, a Greenlee hydraulic pipe bender was called into play to bend the contractor's own ells on a 20 in. radius. From various distances the conduit was pushed into a hole at the pedestal location, the stiff arm removed, the ell joined to the pipe by a threadless connector and then pushed into place.

Incidentally, it is interesting to note that while the contract specified installation of considerable 3-in. conduit, it was found very difficult for one man to push any great length of this large pipe. However, the machine had ample power to perform the work, so Mr. Veale conceived the idea of electrifying one pusher for this purpose, taking a reduction gear with an eccentric action, mounting it on top of the pusher, connecting the eccentric to the high pressure side of the pump, equipping the worm gear with a ¾-hp., single-phase, 110-220-volt motor and using the low pressure side as a release. This made it possible for one man to push 3-in. conduit and all the operator needed to do was to feed pipe to the machine.

Mr. Veale states that he can highly recommend this procedure to any contractor or city desiring to install pipes underground without incurring the tremendous expense involved in cutting and replacing pavement over the entire route, since by the use of this method he was enabled to save his company more than $9,000 on the job described, besides paying for the machines, both of which economies were not anticipated at the beginning. This project was completed in less than ten weeks, working from fifteen to 73 men at a time.

Creditable Depression Engineering in Bay State

Private utilities in Massachusetts have reason to find considerable satisfaction in their never-ceasing warfare against energy losses. Figures covering all these companies have just been prepared for the past four years and these show that the proportion of lost and unaccounted-for energy has been brought down from 10.13 per cent to 9.72 per cent of all kilowatt-hours generated and purchased, while the proportion of energy consumed by the companies themselves in their plants and offices fell from 3.05 per cent to 2.4 per cent of the total delivered to the buses. In 1932 the total energy generated and purchased was 4,882,483,574 kw.-hr., a gain of 1.46 per cent over 1931. This represented an increase of 5.54 per cent over the halcyon days of 1929. Total sales of energy in 1932 were 4,288,549,662 kw.-hr., a gain of 2.12 per cent over 1931 and 6.77 per cent above 1929. These data are a tribute to the work of the sales organizations of these power companies and to that of other retail outlets under the handicap of the worst depression in modern times. That the engineers have likewise not been idle is apparent from even brief consideration of the energy losses in these years.

The total lost and unaccounted-for energy in 1932 was 474,727,413 kw.-hr., or 2.38 per cent less than in 1931. Back in 1929 the losses were 468,444,050 kw.-hr. It is significant that in the four-year period the losses increased but 1.34 per cent in gross total, while sales mounted 6.77 per cent, and also that in the final year there were lower gross losses with an increased delivery of energy to customers. There has been a steady effort in engineering circles to cut down waste of energy in plants and in company use, and the campaign has borne results. The percentage improvements may look small in themselves, but they apply to enormous unit totals. Thus, if every kilowatt-hour lost in 1932 is valued at the low figure of 1 cent, the total losses represent $4,747,274, and on this basis the reduction in gross losses between 1931 and 1932 would be worth $115,780. It is clear that money expended for economical transmission and distribution engineering deserves its place in the sun.

Electrical Energy Output of Private Companies in Massachusetts

	1929	1930	1931	1932	Per Cent Increase in 1932 Over 1929	Per Cent Increase in 1932 Over 1931
Generated by steam	2,201,540,444	2,087,204,989	1,939,523,331	1,536,347,356	— 30.21	— 20.79
Generated by water power	581,245,704	568,594,215	571,773,254	733,775,798	+ 26.24	+ 28.33
Generated by oil	1,840,018	2,343,910	2,888,548	3,119,150	+ 69.52	+ 7.98
Total generated	2,784,626,166	2,658,143,114	2,514,185,133	2,273,242,304	— 18.36	— 9.58
Purchased	1,841,488,025	1,938,032,435	2,297,960,914	2,609,241,270	+ 41.69	+ 13.55
Total generated and purchased	4,626,114,191	4,596,175,549	4,812,146,047	4,882,483,574	+ 5.54	+ 1.46
Sold to commercial customers	2,262,071,309	2,171,119,667	2,107,641,876	1,955,640,230	— 13.55	— 7.21
Sold for street lights	84,632,427	91,467,657	95,409,254	98,502,753	+ 16.39	+ 3.24
Sold to other companies	1,669,878,750	1,734,040,360	1,996,473,299	2,234,406,679	+ 33.81	+ 11.92
Total sold	4,016,582,486	3,996,627,684	4,199,524,429	4,288,549,662	+ 6.77	+ 2.12
Used in plant by companies	141,087,655	135,000,000*	126,316,154	119,206,499	— 15.51	— 5.63
Lost and unaccounted for	468,444,050	464,547,910*	486,305,464	474,727,413	+ 1.34	— 2.38
Total sold, used and unaccounted	4,626,114,191	4,596,175,594	4,812,146,047	4,882,483,574	+ 5.54	+ 1.46
Per cent of unaccounted for	10.13	10.11*	10.11	9.72	....	....

*Estimated.

Three 30,000-Kw. Electric-Steam Generators in Paper Mill

By V. R. YOUNG

Canadian General Electric Company, Ltd., Toronto, Canada.

ON March 10 Arthur A. Schmon, vice-president and general manager Ontario Paper Company, Thorold, Ont., closed a switch which marked officially the commencement of operation of the world's largest single tank electric-steam generators. Now, after five months' operation, the results from these boilers appear to be highly satisfactory.

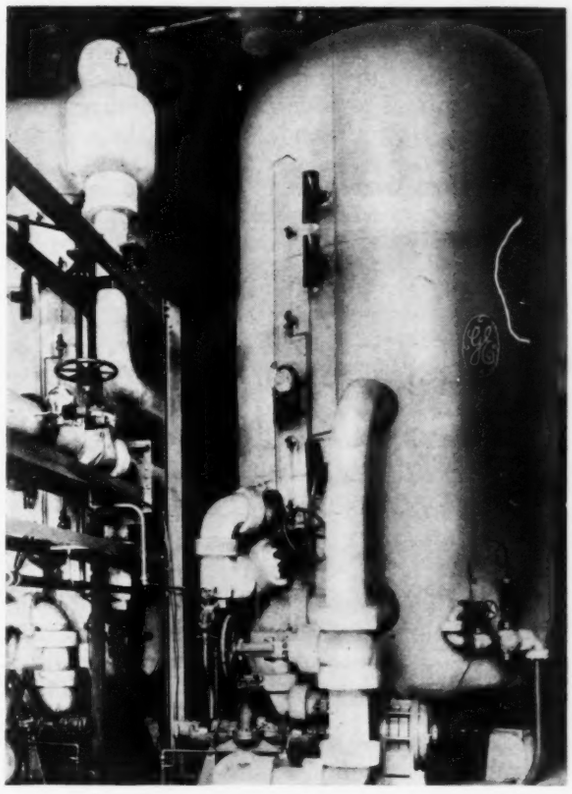
The Ontario Paper Company has been carrying out a plan of general mill rehabilitation for the past two years, which had reached the stage of replacing the existing coal-fired steam power plant presumably with new high-pressure coal-fired boilers. Electric-steam generators, however, were chosen and the installation, designed and installed by the Hydro-Electric Power Commission of Ontario, supplies the paper company's total steam demand at a pressure of 200 lb. per square inch gage and replaces steam previously supplied from coal-fired boilers, which consumed about 70,000 tons of coal per year.

Briefly, the installation consists of an outdoor step-down transformer station, converting 110,000 volts, 25-cycle power to 6,600 volts, and, indoors, the bank of three General Electric three-phase electric-steam generators, each rated at 30,000 kw. and producing approximately 90,000 lb. of steam per hour each. Power is supplied from the commission's Queenston hydro-electric generating station over existing 110,000-volt lines that are tapped close to the company's property. Four 22,500-kva. (one spare), single-phase, 25-cycle transformers step the voltage down from 110,000 volts to 6,600 volts for the steam generators.

Each steam generator consists of a vertical cylindrical tank 11 ft. 6 in. in diameter and 25 ft. high, with a shell thickness of $1\frac{3}{8}$ in., the head thickness being $2\frac{7}{16}$ in. Each generator has two main chambers; the lower part of the tank provides approximately 9 ft. of water storage, while the upper portion provides steam space. In the upper portion a conical bottom, open top cylindrical tank, or basket, is supported so that the vertical electrodes hang from the shell top head down into the basket.

The water in the generators is continuously circulated, being drawn from the storage portion and delivered to the basket above by a centrifugal pump; part is evaporated into steam in the basket, and the balance returns from the basket to the storage by an external pipe connection. A valve in the pump discharge regulates the quantity of water delivered to the basket, the water level in the basket, and, therefore, the amount of electrode immersion or the rate of steaming. A valve is provided in the drain from the basket to regulate the amount of water drained as may be required by operating conditions. Two other connections are made to the drain—one for periodic blow-off, the other for continuous bleeding from the basket.

In each steam generator there are six hollow triangular-shaped cast-iron electrodes, approximately 4 ft. long, and rigidly supported and insulated from the top head. Power is fed to these electrodes by copper rods that enter the tank through specially designed porcelain insulating bushings. The basket shell also forms one path of the current and it is so arranged that any pitting which may develop occurs on the basket and not on the tank. Any pitted sections of the basket shell may thus be readily removed and new sections welded in.



6,600-volt, 30,000-kw., three-phase, 25-cycle steam generator

Power for three of these is derived from a bank of three single-phase (and one spare) Canadian General Electric transformers, each rated 121,000Y/6,600 volts, 22,500 kva., 25 cycles.

Each generator gives approximately a minimum steam output of 18,000 lb. of steam per hour, which requires an electrical input of 6,000 kw. and an electrode immersion of 6 in. Lower steaming rates are not possible due to the unstable electrical operation with less than 6 in. immersion, but it is notable that the formation of hydrogen and oxygen is negligible when the current density is kept sufficiently low.

Each generator is provided with a steam separator to assure a steam quality of 99 per cent dry at the separator outlet. A stop valve is inserted between the generator and the separator and an automatic stop check valve in each 10-in. generator steam branch to the header.

Feedwater is supplied to the generators by a four-stage centrifugal pump designed for 500 g.p.m. against 580 ft. head. At the delivery to each generator a feedwater regulator is provided to maintain a constant level of water in the low portion of the generator tank.

Since the steam branches from each generator had to be arranged in line with the header, because of the space limitations for the generators, and to accommodate the orifices for individual steam meters on each generator, expansion was provided for by two copper expansion joints, one each side of the steam main center branch tee.

Each separator and each stop check valve is provided with a valved pipe drain connected to separate drain headers supported below the main steam header. The drain headers are connected to a continuously draining trap that discharges the water to a flash tank. This arrangement of drains provides thorough drainage of the steam piping at all times, and, therefore, the elimination of water hammer.

The generators were built to the Canadian interprovincial regulation and each generator was equipped with four high-capacity safety valves complete with vertical discharge pipes through the roof and drain pipes for condensed steam.

A totalizing kilowatt-hour meter and a graphic wattmeter for measuring the electrical input to the three generators on the 6,600-volt bus have been provided by the commission and the paper company has provided the following steam and water meters for measuring the steam-generated output: Steam flow, orifice type recording flow meter for each generator; feedwater, Venturi recording meter for all generators; make-up water, orifice type recording meter for all generators; bleedwater, orifice type recording meter for all generators discharging to drain.

The steam generators and steam piping were insulated with an insulating material which has a strong bonding characteristic to hot metal, can be quickly applied and easily removed and replaced in case of leakage.

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Oil Under Pressure Used in 16.5-33-Kv. Changeover

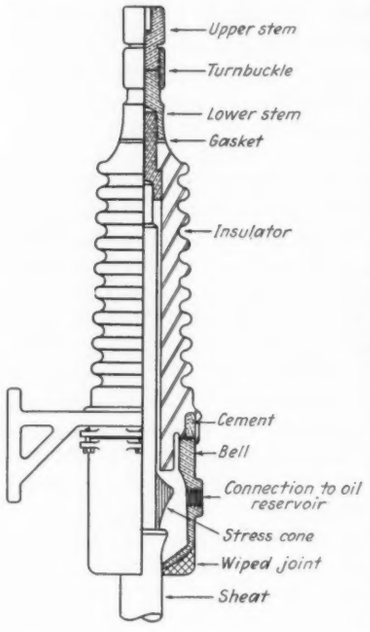
By GEORGE H. LOGAN

Los Angeles Gas & Electric Corporation

Recently the Los Angeles Gas & Electric Corporation converted its 16.5-kv. transmission system to 33-kv. operation. A problem incidental to the changeover was that of providing adequate dielectric strength to cable terminals at the new voltage. It was decided this could best be accomplished by the use of oil under pressure.

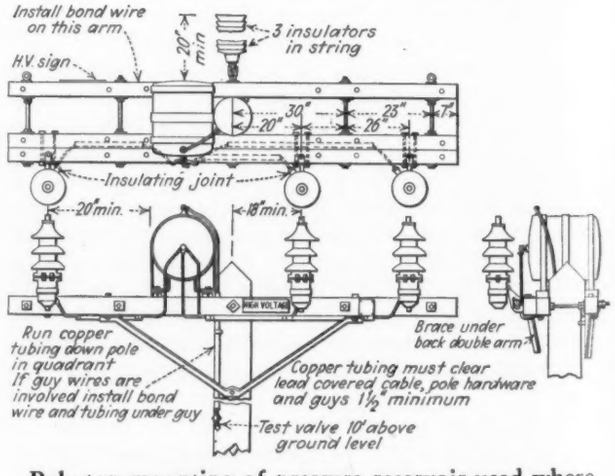
Prior to the change the terminals in general use were of three-conductor, compound-filled construction. These could not readily be adapted to use with oil under pressure, making necessary the substitution of three single-conductor terminals. Single-conductor cables were run from the terminals in the substation to the first manhole, where a threeway splice was made into the standard three-conductor transmission cables. Each terminal was supplied with a high-grade transformer oil through copper tubing connected to an oil reservoir. Compressed air in the reservoir provided the necessary pressure, and this air was confined in a section of the reservoir separated from the oil by flexible diaphragms. Thus the oil was not exposed to the air. Insulating spacers were inserted in the oil line to each terminal to prevent circulating sheath currents. From three to nine terminals were connected to each reservoir.

Neither the terminals nor splices were equipped with stopjoints to prevent the oil from penetrating the insulation of the cable. In fact, the diffusion of oil throughout the 33-kv. cables is highly desirable, as even in "solid" insulation there exist voids which are possible sources of breakdown. The oil pressures used in pole, manhole and substation reservoirs were adjusted to produce an approximately uniform density of oil throughout the lengths of intervening cable. To secure such uniformity the factor of relative elevations had to be considered. If, for example a highline was to be carried from a pole to underground the oil pressure given to the nearest manhole reservoir would be about 10 lb. per square inch, while the adjacent pole reservoir would carry perhaps only 2 lb. per square inch. This differential prevented the oil draining by gravity from the upper to the lower portion of the cable.



Oil-filled cable terminal used in 33-kv. changeover

Before transferring oil from reservoir to terminal the lower stem of the terminal was screwed down until only a small distance intervened before it would seat in the gasket. All connections between reservoir and terminal were made tight and the small valve on the reservoir was opened so that the oil flowed into the base of the unit. In rising the liquid penetrated every crevice and simultaneously forced air out through the top. When the oil leaked out around the surmounting stem, excluding all air, this stem was tightly screwed down on its seat, allowing the gasket effectively to seal the interior from the atmosphere.


Install bond wire on this arm
20" min.
3 insulators in string
H.V. sign
30"
20"
26"
23"
Insulating joint
20" min.
18" min.
HIGH VOLTAGE
Run copper tubing down pole in quadrant If guy wires are involved install bond wire and tubing under guy
Brace under back double arm
Copper tubing must clear lead covered cable, pole hardware and guys 1½" minimum
Test valve 10' above ground level

Pole top mounting of pressure reservoir used where overhead circuits are brought underground

Men of the Industry

G. E. Arbogast, president of the Newbery Electric Corporation and of the Interstate Securities Corporation, Los Angeles, has been appointed as a member of the Los Angeles, Cal., Harbor Commission to succeed Col. F. C. Wiser, resigned. Mr. Arbogast is president of the Electrical Contractors and Dealers' Association of Southern California.

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Dr. Jerome C. Hunsaker, international authority on aviation engineering, has been appointed head of the department of mechanical engineering at the Massachusetts Institute of Technology, succeeding the late Prof. Edward F. Miller. Dr. Hunsaker is at present vice-president of the Goodyear-Zeppelin Corporation and will continue as consulting engineer on airships to that organization. He will also have charge of the aeronautical engineering course and research in that field and in meteorology at M.I.T. His many contributions to aviation include pioneer work in the field of radio communication and meteorology, leading to the establishment of the present service between moving aircraft and ground stations on airways.

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Thomas D. Fulford, who has been associated with Stone & Webster since 1919, has recently been appointed general sales manager of the Puget Sound Power & Light Company, a Stone & Webster property, with offices in Seattle. Mr. Fulford started in the meter department in Seattle in 1919 and after three years of service was transferred to the Savannah Electric & Power Company as assistant sales manager, in 1925 becoming sales manager of the properties at Baton Rouge. Returning to Savannah as sales manager in 1925, he remained there until 1929, when he went to Norfolk with the Virginia Electric & Power Company as sales manager of the Norfolk division. A graduate of the University of Cincinnati, Mr. Fulford received his early experience with the laboratories of the Philadelphia Electric Company.

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Lieut.-Col. K. G. Maxwell, electrical engineer, has been appointed publicity manager of Metropolitan-Vickers Electrical Company, Manchester. Following the World War, Colonel Maxwell entered the research department of Metropolitan-Vickers, and in the research department was responsible for investigating insulating materials. He has served as a member of the British Standards Institution Technical Committee on insulating materials and on a number of subcommittees, especially those investigating synthetic resin products and insulating oils, and he has also been active in the Electrical Research Association. Colonel Maxwell became prominent in engineering circles in 1925, when the paper he presented to the Institution of Electrical Engineers, in conjunction with Alan Monkhouse, one of the engineers in the Moscow trial, was awarded the Kelvin prize.

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OBITUARY

Robert Lindsay

Robert Lindsay, president and general manager of the Cleveland Electric Illuminating Company, died August 25 at his home in University, Va., in his sixty-fourth year. He had been in failing health for a year and had gone to University for a rest, hoping that the change of climate would be beneficial. A native of Rahway, N. J., Mr. Lindsay at an early age visited the Edison laboratory at Menlo Park, which was near his home, and, becoming acquainted with many of Edison's assistants, developed a deep interest in electricity. At the age of sixteen he obtained a position in the experimental lamp-testing division of the Edison Lamp Works at Harrison, working under the supervision of John W. Howell, Edison's famous associate, after which he was transferred to the instrument department. Later he became assistant to the general manager of the Brooklyn Edison Company, and after four years went to Cleveland as consulting engineer in the construction of the Canal Road power plant of the Cleveland utility.

On June 1, 1894, he became general superintendent of the Cleveland company, where his first task was to finish construction of the Canal Road plant. For the next 39 years he devoted himself entirely to the service of the company and the development of the electrical industry in that city. He was credited with saving the company a substantial sum of money in 1898 by his foresight in building a 60-cycle system when other central stations were installing 25-cycle systems, thereby avoiding the necessity of rebuilding later.

In addition to the Canal Road plant, Mr. Lindsay saw the Lake Shore, Avon and Ashtabula power plants built, the 132,000-volt transmission system by which these plants are interconnected and the distribution system which supplies electricity to 1,500,000 people. Mr. Lindsay was a director of the North American Company, which controls the Cleveland utility. He was a member of the Edison Pioneers and of numerous business organizations in Cleveland.

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Charles E. F. Clarke, president of the Pennsylvania Water & Power Company, died at Rye, N. Y., August 25 after an illness of many months. He was 69 years of age. Mr. Clarke was born at Lawrence, Mass., was graduated from Phillips Andover Academy in 1882 and, after being identified with various enterprises in New England and in the West, he entered the public utility field in New York. At the time of his death he was president of the Safe Harbor Water Power Company, a vice-president of the Consolidated Gas, Electric Light & Power Company of Baltimore, chairman of the board of the Eastern Rolling Mill Company and the Baltimore Tube Company and a director of several other corporations.

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Byron G. Slining, superintendent of construction for the North American Light & Power Company, died August 13 at his home in Chicago. Mr. Slining joined the Illinois Traction System in 1916, and remained associated with succeeding and affiliated utilities until the time of his death. Aside from his power station and general construction experience he had become in later years an authority on steel power transmission line development. Mr. Slining was born September 13, 1885, at Negaunee, Mich. He was educated at the Michigan College of Mines and had wide experience in the design and construction of mining, power, hydraulic and industrial development in the Southwest before his connection with the North American Light & Power group.

New Equipment Available

Muffle Furnace With Doreco Heating Element

Type MP muffle furnace with the "Doreco" heating element has been announced by the Cooley Electric Furnace Company, Long Island City. The Doreco element consists essentially of a material of high heat conductivity, approximately that of steel, and high resistivity, in the order of porcelain, in which is embedded a nickel chromium resistor. It is formed into a dense block by a hydraulic pressure of 4,000 lb. per square inch and then fired at high temperature.

This block is mechanically strong, withstanding a compression force of 600 lb. per square inch at 2,500 deg. F., and can be heated to this temperature without detriment to the material. Consequently, at those temperatures which can be supported by nickel-chromium is available a heating unit that is strong, chemically inert, with the hitherto unknown combination of high electric resistivity and high thermal conductivity.

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Photoelectric Relay

A photoelectric relay using the "Visitron F2" photoelectric cell, which operates without external source of voltage and without amplification, is announced by the G-M Laboratories, Inc., Chicago. The complete unit, designated as the "FSE" photoelectric relay, incorporates a "Visitron F2" cell, a sensitive relay and an auxiliary electromagnetic relay housed in a small, compact cast aluminum case. The cell can be mounted behind a glass window in the front of the case or externally at any point within hundreds of feet of the sensitive relay.

The F2 cells, the auxiliary relays, or the two relays in combination, can be supplied either assembled or individually as required for various electrical or photoelectric applications.

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PORTABLE ELECTRICAL INSTRUMENTS designated as type AP-9, including medium-size voltmeters, milliammeters, ammeters and wattmeters, have been announced by the General Electric Company. Intermediate in size and accuracy between the small, pocket-size instruments and the large, highly accurate portable, the new instruments are of higher accuracy than is usually found in utility instruments, it is claimed. The length of the scale in mean arc is 4¼ in. The accuracy is 0.75 per cent of full-scale value, except in the case of the triple-range voltmeters, in which it is 1½ per cent, and can be improved by special calibration on the job. An AP-9 instrument can be read easily to within 0.5 per cent of full-scale value.

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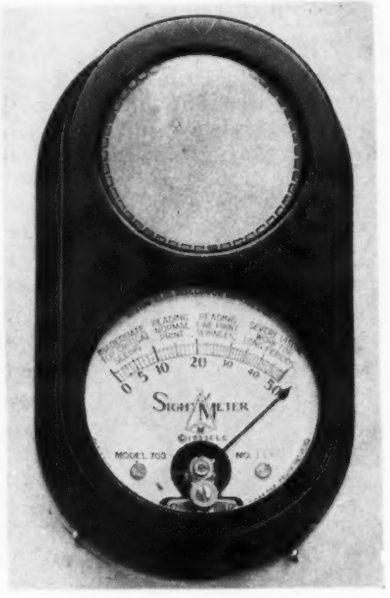
Compact Direct-Reading Illuminometer

A self-contained direct-reading illuminometer which can be held in the palm of the hand and used without any accessories or attachments is being marketed by the Sight-Light Corporation,



Chrysler Building, New York, under the name of the "Sight-Meter." Its compact case incloses a Weston photronic cell and meter the scale of which is labeled so even a child can determine whether the light in any position is sufficient for reading normal print, fine print, sewing, etc., severe visual work for long periods, or inadequate for critical seeing. The scale also indicates foot-candle illumination. With a special filter to cover the photronic disk its normal measuring range of 0-50 ft.-candles is increased to 500 ft.-candles, in which case the scale reading is multiplied by ten.

Of its many applications in the home, office, store, factory and school may be mentioned: Checking the adequacy of artificial or natural light in any position; when lamps should be replaced; relative value of foreign and "Mazda" lamps; necessity of cleaning fixtures, walls and ceilings; effect of different paints on seeing ability; most efficacious arrangement of work with respect to light; necessity of supplementary illumination and attention-compelling light intensities of window displays.

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Electric Timers

A utility time switch to serve miscellaneous needs, a thermostat timer and an electric-range timer are included in the new type T-14 time switches which have been announced by the General Electric Company. The utility switch turns on and off once every 24 hours. It will turn radio sets on and off and it is only necessary to plug the timer into any outlet and set it.

The electric-range timer is so arranged that the on-off cycle is not repeated automatically. It is used to turn the oven of an electric range on and off automatically. The thermostat timer is for use with double-range, day and night, thermostats commonly employed in the control of house-heating systems. There is an a.m. and p.m. time indicator and a dial for setting the clock at a.m. or p.m. time.

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MANUFACTURE OF SLIDING CONTACT TUBULAR RHEOSTATS has been announced by the Ward Leonard Electric Company, Mount Vernon, N. Y. These precision instruments are designed for the accurate control of currents up to 25 amp. They are arranged for potentiometer connection and may be obtained with non-inductive or tapered resistance windings.

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"IRC" VOLT-OHMMETER, which is a complete piece of test equipment covering voltage and resistance, has been announced by the Bakelite Corporation. Some of the features of this instrument are: Exclusive vacuum relay, which prevents costly burn-outs of meters; four voltage and three resistance ranges; easy-to-read knife-edge pointers, etc.

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A PHOTRONIC CONTROL KIT which is being marketed especially for those engineers and manufacturers who prefer to do their own experimenting with photoelectric control for mechanical equipment, operations and for processes of various kinds has been announced by the Weston Electrical Instrument Corporation, Newark, N. J. The kit contains all the equipment necessary for the engineer to start immediate experiments, together with diagrams of connections. The equipment can be used as a smoke detector, burglar alarm, turbidity detector, door opener, counter for all classes of service, safety device on machines, etc.